Nokia Customer Care

Service Manual

RM-429 (Nokia 3610 fold)
Mobile Terminal
Part No: (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	07/2008	A. Salo	

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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise the GSM PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 3610 fold Service Manual Structure

1 General information
2 Service Tools and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 System Module
Glossary

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1 — General information

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Product selection

RM-429 is a quadband GSM handportable phone that supports GSM850/900/1800/1900 bands.

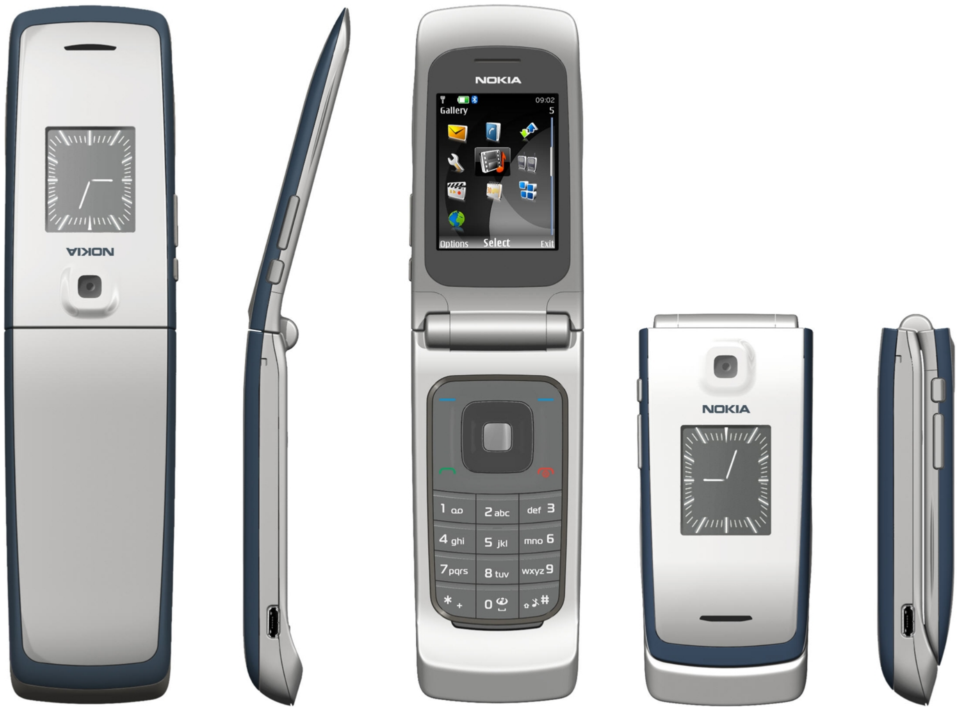

Figure 1 View of RM-429

Phone features

Hardware characteristics

- Fold Form Factor
- Quad-band GSM 850, 900, 1800, 1900
- EDGE Rel. 4: MSC 32 (5DN/3UP/6SUM)
- GPRS: MSC 32 (5DN/3UP/6SUM), class B&C
- Speech codec support for AFR/AHR/EFR/FR/HR
- 30MB user memory and (empty) MicroSD card slot
- Douglas 8 UI on primary display, Fold 4 UI on secondary display
- 2.0” 240x320 pixel, 262k TFT color primary display
- 1.36” 128x160 pixel 262k TFT color secondary display
- 1,3MPix camera with 6x digital zoom, portrait mode
- Bluetooth version 2.0 + EDR supporting SAP (SIM Access Profile), OPP (Object Push Profile), FTP (File Transfer Profile), DUN (Dial-up Networking Profile), HSP (Headset Profile), HFP (Hands-Free Profile), SDAP (Service Discovery Application Profile), GAP (Generic Access Profile), SPP (Serial Port Profile), GOEP (Generic Object Exchange Profile)
- Micro USB
- 2.5mm Nokia A/V connector
- 5-way , two soft keys, send and end keys
- Side volume keys with the zoom functionality

- Dedicated camera sidekey
- Music Player with customizable skins
- MicroSD card slot
- Internal vibra and antenna
- M3 HAC Compliance

UI features

- New Series 40 UI
- Active stand-by

Applications/service enablers

- Video streaming and recording in QCIF (176x144 pixel)
- XHTML browsing over TCP/IP
- SAIC
- Skins (wallpapers, icons, colors)
- Music Player supporting MP3, MP4, AAC, eAAC+ and Windows Media Player
- PIM (Calendar & Contacts)
- Presence Enhanced contacts – OMA IMPS
- Nokia Xpress audio messaging (AMS)
- Flight mode
- OMA DRM 1.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- Java&APIs: MIDP2.0, JSR139 (CLDC1.1), JSR75 (file connection and PIM), JSR135, JSR184 (3D), JSR82 (BT)
- 3GPP H.263 playback+streaming and MPEG4 video and playback
- Video, MP3, AAC, eAAC+ and 64 polyphonic ringing tones
- WAP 2.0, XHTML browser over HTTP/TCP/IP stack
- SyncML (local and remote)
- E-mail client with attachment
- Nokia PC Suite Version 7.0

Services

- OTA download of ringing tones, themes, wallpapers
- Download/upload images and video sequences
- FOTA – Firmware update over the air
- Plug and play services
- IM (AOL, ICQ, Yahoo, MSN)
- HAC
- SIM access profile in BT

Accessories

Sales package contents

- 3610 Tranceiver
- BL-5C Battery
- AC-3 Charger
- User Guide

Table 1 Battery and chargers

Type	Name
AC-3	Compact charger
AC-4, AC-5	Travel performance charger
BL-5C	Battery 1020 mAh Li-Ion

Table 2 Car accessories

Type	Name
HF-33W, HF-200, HF-300	Wireless plug-in handsfree
CK-100, CK-15W, CK-300, CK-7W	Wireless carkit

Table 3 Headsets

Type	Name
BH-101, BH-102, BH-201, BH-202, BH-208, BH-212, BH-300, BH-304, BH-305, BH-502, BH-600, BH-602, BH-700, BH-701, BH-702, BH-703, BH-803, BH-804, BH-900, BH-902, BH-904	BT mono headset
BH-503, BH-604, BH-903	BT stereo headset
HS-104, HS-105, HS-42, HS-47	Wired voice/music headset
HDA-11	Hearing aid

Table 4 Data

Type	Name
CA-101	Micro USB data cable
CA-100	USB data cable

Table 5 Memory cards

Type	Name
MU-22, MU-27, MU-28, MU-37, MU-41	Memory card

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
RM-429 transceiver with BL-5C 1020 mAh Li-Ion battery pack	99.6 x 44.3 x 19.6	97	67.6

Battery endurance

Battery	Talk time	Standby time
BL-5C 1020 mAh Li-ion	GSM - up to 4h 38min	GSM - up to 457h

Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

Environmental conditions

Temperature

Temperature range	Min ºC	Max ºC
Operational (all specs met)	-5	+55
Functional (reduced performance)	-30	+70
Storage	-30	+85

The HW module complies with the SPR4 Operating Conditions.

Humidity

Relative humidity range is 5...95%.

The hardware module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

The hardware module complies with the SPR4 Operating Conditions.

Electrical characteristics

Table 6 Normal and extreme voltages

Voltage	Voltage (V)	Condition
General conditions		
Nominal voltage	4.0	
Lower extreme voltage	3.06	a
Higher extreme voltage	4.2	b
Min operating voltage		
Vcoff+	3.1 ± 0.1	Off to on
x	2.8 ± 0.1	On to off

a. ADC settings in the SW might shutdown the phone above this value.

b. During fast charging of an empty battery, this voltage might exceed this value. Voltages between 4.20 and 4.60 might appear for a short while.

Main RF characteristics for GSM850/900/1800/1900 (quadband) and EDGE phones

Table 7 Main RF characteristics

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900 and EDGE
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850: +5 … +33dBm/3.2mW … 2W
	GSM900: +5 … +33dBm/3.2mW … 2W
	GSM1800: +0 … +30dBm/1.0mW … 1W
	GSM1900: +0 … +30dBm/1.0mW … 1W

Parameter	Unit
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 194
	GSM1800: 374
	GSM1900: 299
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of EDGE Tx power levels	GSM850 EDGE: 12
	GSM900 EDGE: 12
	GSM1800 EDGE: 14
	GSM1900 EDGE: 14

2 — Service Tools and Service Concepts

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Service tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-429. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

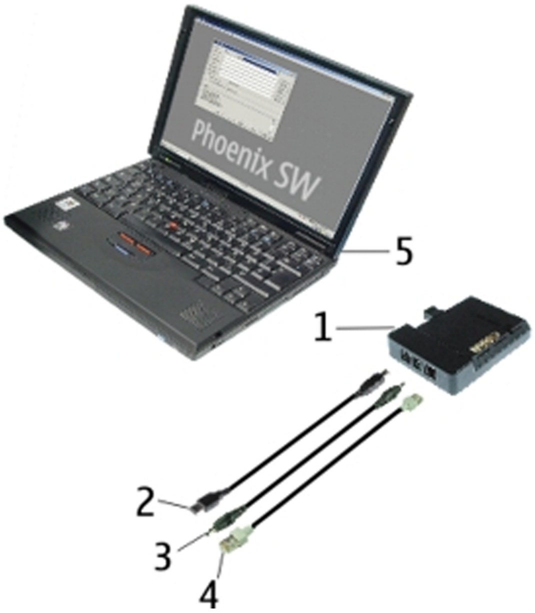
1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

5 Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"> </td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.
Note: FLS-5 can be used as an alternative to PKD-1.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable
Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.</td></tr>
</table>

FS-57	Flash adapter	

- FS-57 is equipped with a clip interlock system
- provides standardised interface towards Control Unit
- provides RF connection using SA-130 coupler.

  For attenuation values, see Attenuation values for SA-130 (page 2–15).
- multiplexing between USB and FBUS media, controlled by VUSB

Phone Mounting Instructions:

1. Ensure blades lock into adaptor clips.
2. Carefully lower phone down while pulling pin lock lever back.
3. Once phone is properly seated, release the locking pin lever to lock phone.
4. At an angle, align the battery connector blades to adaptor battery connector clips.
5. Verify phone comes up in the chosen selected mode.

   Note: Always use adaptor lever before removing phone from adaptor, otherwise, adaptor locking pin could break.

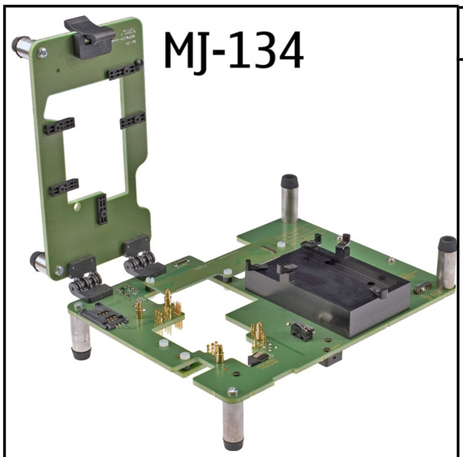
Spare parts for FS-57:

- SPARE LOCKING PIN FOR FS-57 (7780112)
- PACK OF 10 TEST PINS (770754)
- TEST PIN(S) (770442)

JXS-1	RF shield box	

Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal.

The shield box is not an active device, it contains only passive filtering components for RF attenuation.



MJ-134	Module jig	

MJ-134 is meant for component level troubleshooting.

The jig includes an RF interface for GSM and Bluetooth. In addition, it has the following features:

- Provides mechanical interface with the engine module
- Provides galvanic connection to all needed test pads in module
- For GSM 850, GSM 900, GSM 1800 and GSM 1900 bands, use CA-128RS cable connected to right angle mouth SMA connector on fixture.
- Use losses for CA-128RS cable for correct attenuation values for accurate testing and calibration. For GPS (1485 MHz) band, use CA-128RS with XRS-6 RF cables. CA-128RS connects to jack X6201 located component side top of module. Add losses for CA-128RS RF cable to losses for XRS-6 RF cable for correct attenuation values for accurate testing and calibration. For Bluetooth (2500 MHz) band, use instructions for SB -6 (or JBT-9).
- Multiplexing between USB and FBUS media, controlled by Vusb
- MMC interface
- Duplicated SIM connector
- Connector for control unit
- Access for AV- and USB connectors

For RF attenuation values, see Attenuation values for CA-128RS (page 2–16).

Spare parts for MJ-134:

- TEST PINS 1 PC = 10 PINS (780009)
- TEST PINS 1 PC = 10 PINS (770879)
- TEST PINS 1 PC = 10 PINS (780447)
- TEST PIN(S) (770442)
- PWB FLEX 2AW ASSY (9855326)

DESkey
www.des.co.uk

PK-1	Software protection key	

PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.

PK-1 is meant for use with a PC that does not have a series interface.

To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.

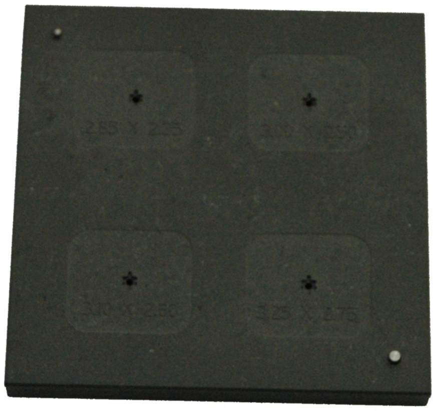
DESkey
www.des.co.uk

PKD-1	SW security device	

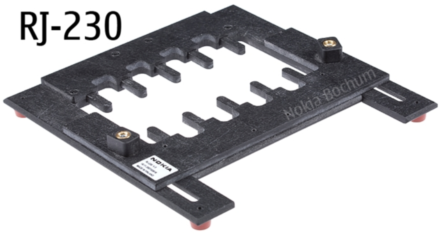
SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.

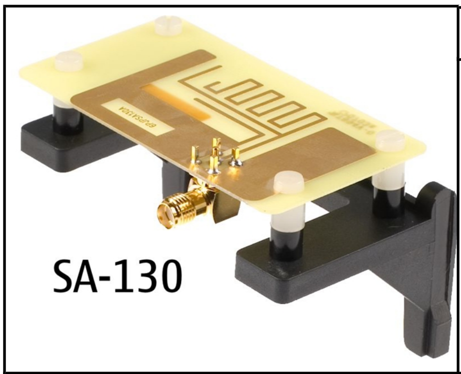
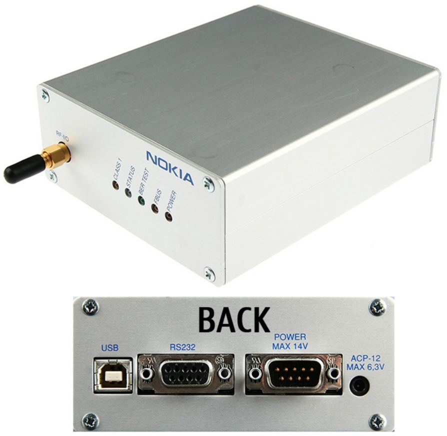
Without the device, it is not possible to use the service software.

Printer or any such device can be connected to the PC through the device if needed.

<table>
<tr><td rowspan="2"></td><td>RJ-160</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-160 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.</td></tr>
<tr><td rowspan="2">

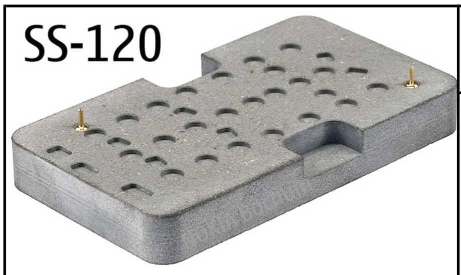
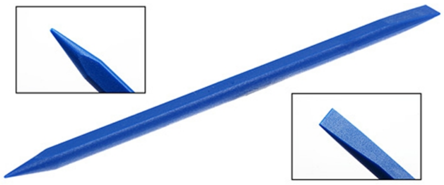
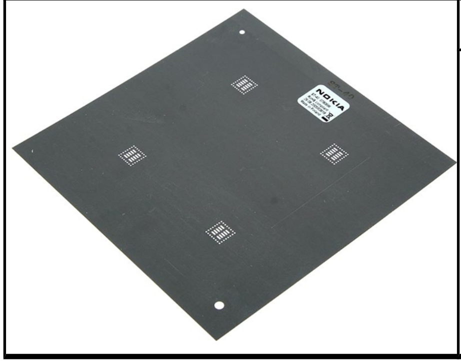
RJ-177
PROTO

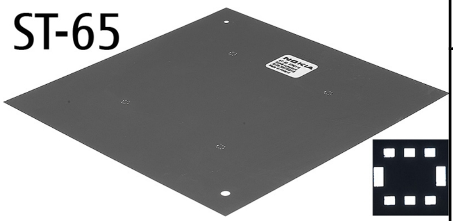
</td><td>RJ-177</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">RJ-177 is a product specific soldering jig used for soldering and as a rework jig for the engine module. Alternatively to RJ-177 and depending on the availability, RJ-230 Universal Soldering Jig can be used. Both RJ-177 and RJ-230 have the same function. RJ-230 is the preferred tool.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-201</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">This jig is used in conjunction with the ST-65 stencil.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-230</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">RJ-230 is a universal soldering jig used for soldering and as a rework jig for the engine module. Alternatively to RJ-230 and depending on the availability, RJ-177 product specific soldering jig can be used. Both RJ-177 and RJ-230 have the same function. RJ-230 is the preferred tool.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-93</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-93 is used as a rework jig for the engine module.
This jig is used in conjunction with the ST-40 stencil for spreading the soldering paste to the N7501 component.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>SA-130</td><td>RF coupler</td><td></td></tr>
<tr><td colspan="3">The SA-130 coupler is for GSM RF Go/No Go testing. It interfaces with the FS-52 and SS-62/CU-4 interface adapters. It allows RF function testing in GSM bands of 850, 900, 1800 and 1900 MHz.
Note: SA-130 is not suitable for RF tuning.
For RF attenuation values, see Attenuation values for SA-130 (page 2–15).</td></tr>
<tr><td rowspan="2"> </td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2">

NOKIA
SPS-1 0770381
MADE IN FINLAND

</td><td>SPS-1</td><td>Soldering paste spreader</td><td></td></tr>
<tr><td colspan="3">The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.</td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.</td></tr>
</table>

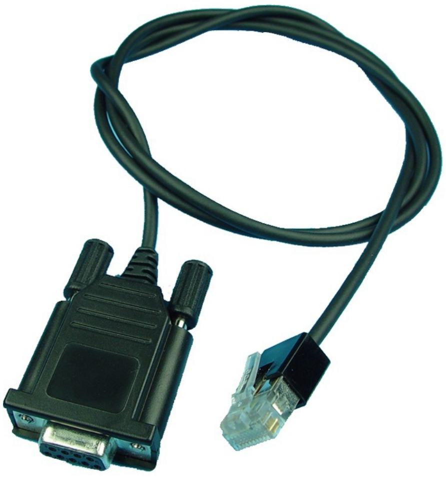
	SS-120	Domesheet alignment tool	
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	SS-88	Camera removal tool	
	The camera removal tool SS-88 is used to remove/attach the front camera module from/to the socket.		
	SS-93	Opening tool	
	SS-93 is used for opening JAE connectors.		
	ST-40	Rework stencil	
	ST-40 is a rework stencil and used with RJ-93.		

	ST-55	Rework stencil	
	ST-55 is a rework stencil used with rework jig RJ-160.		
	ST-65	Rework stencil	
	ST-65 is a rework stencil used with rework jig RJ-201.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-429. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CA-101 100cm	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.		
	CA-128RS	RF tuning cable	
	Product-specific adapter cable for RF tuning. For attenuation values refer to Attenuation values for CA-128RS (page 2–16).		

<table>
<tr><td rowspan="2"> </td><td>CA-31D</td><td>USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.</td></tr>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
<tr><td rowspan="2"></td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Attenuation values for SA-130

Band	Channel	Freq.	Attenuation RX	Freq.	Attenuation TX
GSM 850	Low	869.2	-13.4	824.2	-15.5
	Mid	881.6	-12.5	836.6	-15
	High	893.8	-11.7	848.8	-14.2

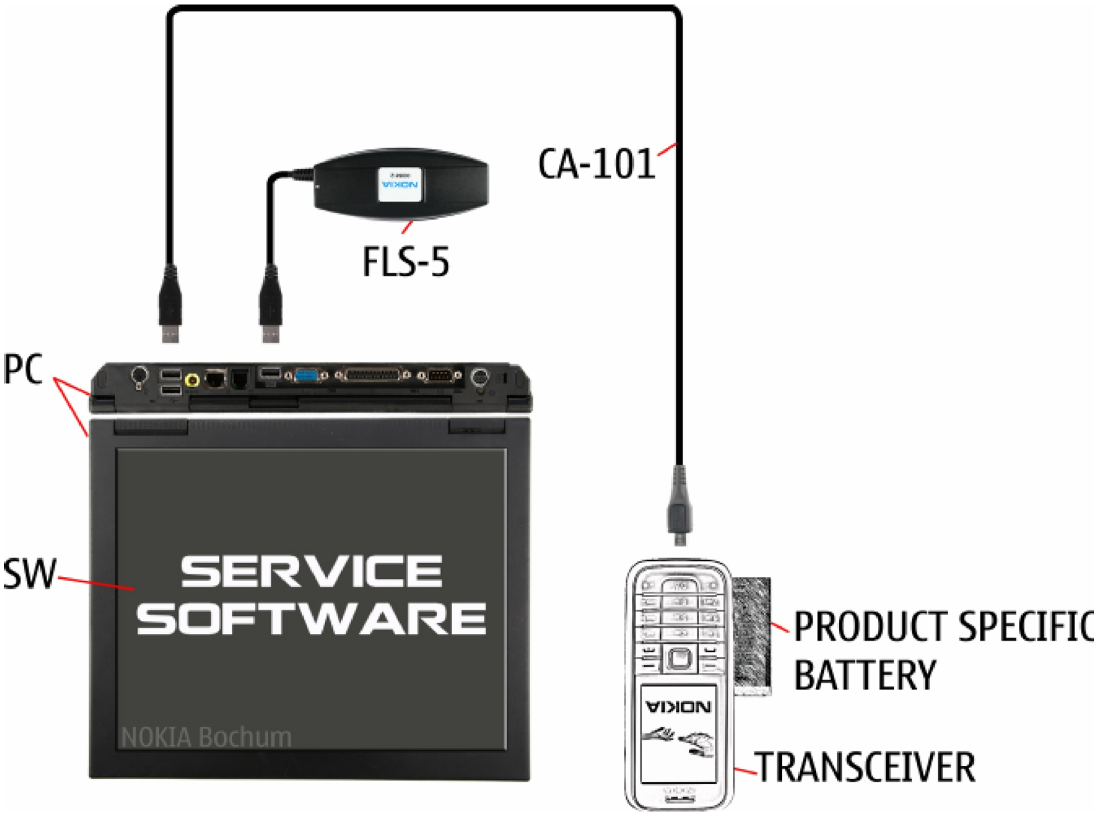
Band	Channel	Freq.	Attenuation RX	Freq.	Attenuation TX
GSM 900	Low	925.2	-10.6	880.2	-12.6
	Mid	942.6	-10	897.6	-11.6
	High	959.8	-9.65	914.8	-11.3
GSM 1800	Low	1805.2	-8.5	1710.2	-9.98
	Mid	1842.6	-7.66	1747.6	-9.86
	High	1879.8	-7.15	1784.8	-9.87
GSM 1900	Low	1930.2	-7.27	1850.2	-7.51
	Mid	1960.0	-7.91	1880.0	-7.2
	High	1989.8	-9.15	1909.8	-7.1

Attenuation values for CA-128RS

Band	Channel	RX Frequency	Attenuation RX	TX Freqency	Attenuation TX
GSM 850	Low	869.2	0.3	824.2	0.3
	Mid	881.6	0.3	836.6	0.3
	High	893.8	0.3	848.8	0.3
GSM 900	Low	925.2	0.3	880.2	0.3
	Mid	942.6	0.3	897.6	0.3
	High	959.8	0.3	914.8	0.3
GSM 1800	Low	1805.2	0.5	1710.2	0.5
	Mid	1842.6	0.5	1747.6	0.5
	High	1879.8	0.5	1784.8	0.5
GSM 1900	Low	1930.2	0.5	1850.2	0.5
	Mid	1960.0	0.5	1880.0	0.5
	High	1989.8	0.5	1909.8	0.5
WLAN or Bluetooth	Low	2402	0.6	2402	0.6
	Mid	2450	0.6	2450	0.6
	High	2480	0.6	2480	0.6

Service concepts

POS (Point of Sale) flash concept


CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Type	Description
Product specific tools	
BL-5C	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	Micro USB cable

Flash concept with FPS-10

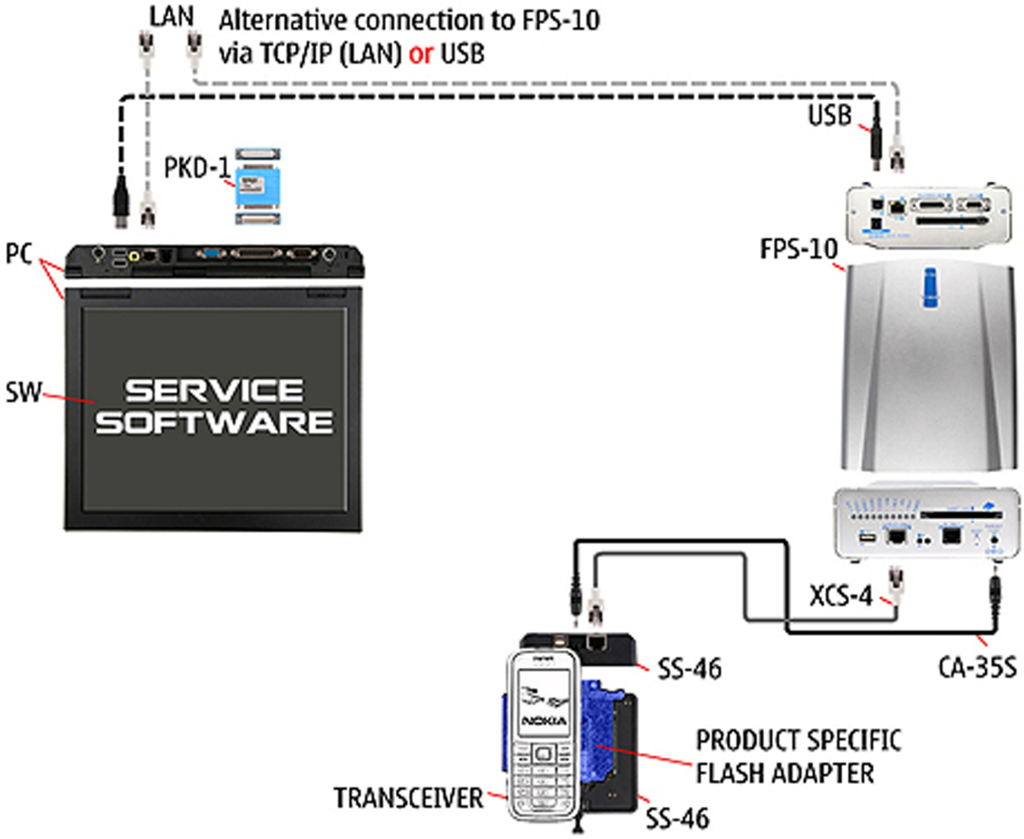
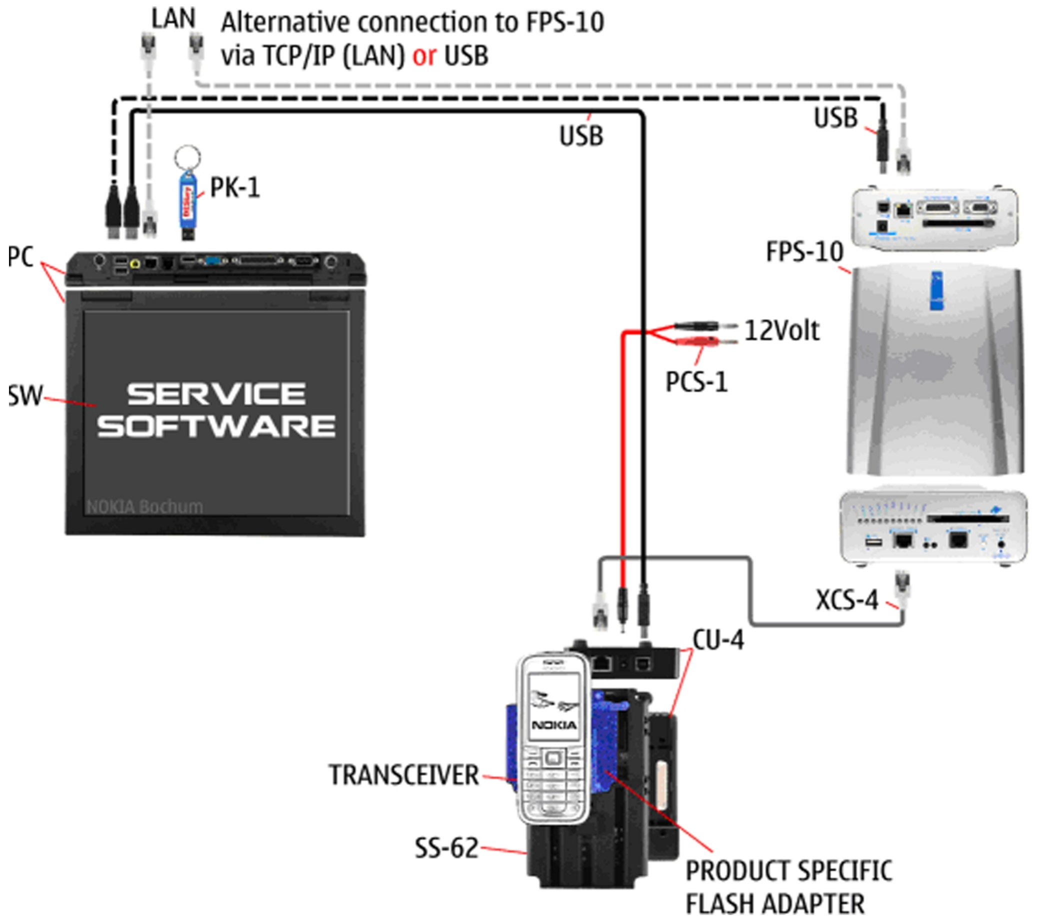

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 2 Basic flash concept with FPS-10

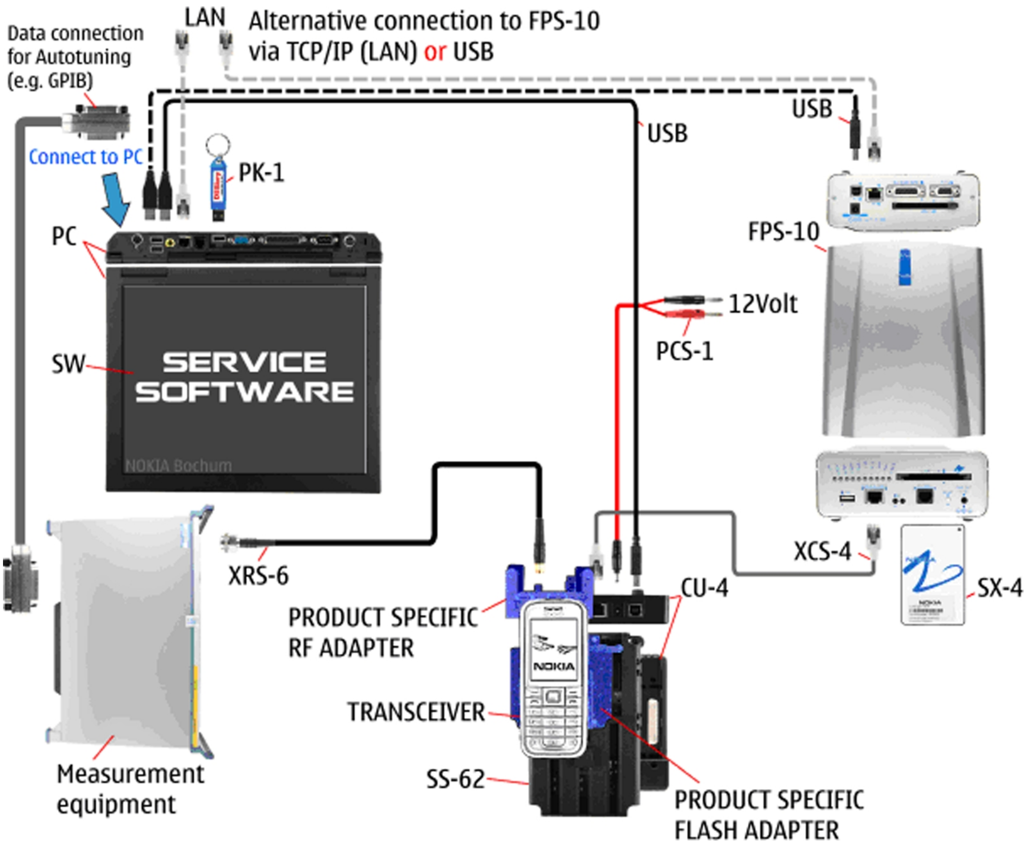
Type	Description
Product specific devices	
FS-57	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

Flash concept with FPS-10 and SS-62


LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
XCS-4
CU-4
TRANSCEIVER
SS-62
PRODUCT SPECIFIC
FLASH ADAPTER

Type	Description
Product specific devices	
FS-57	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

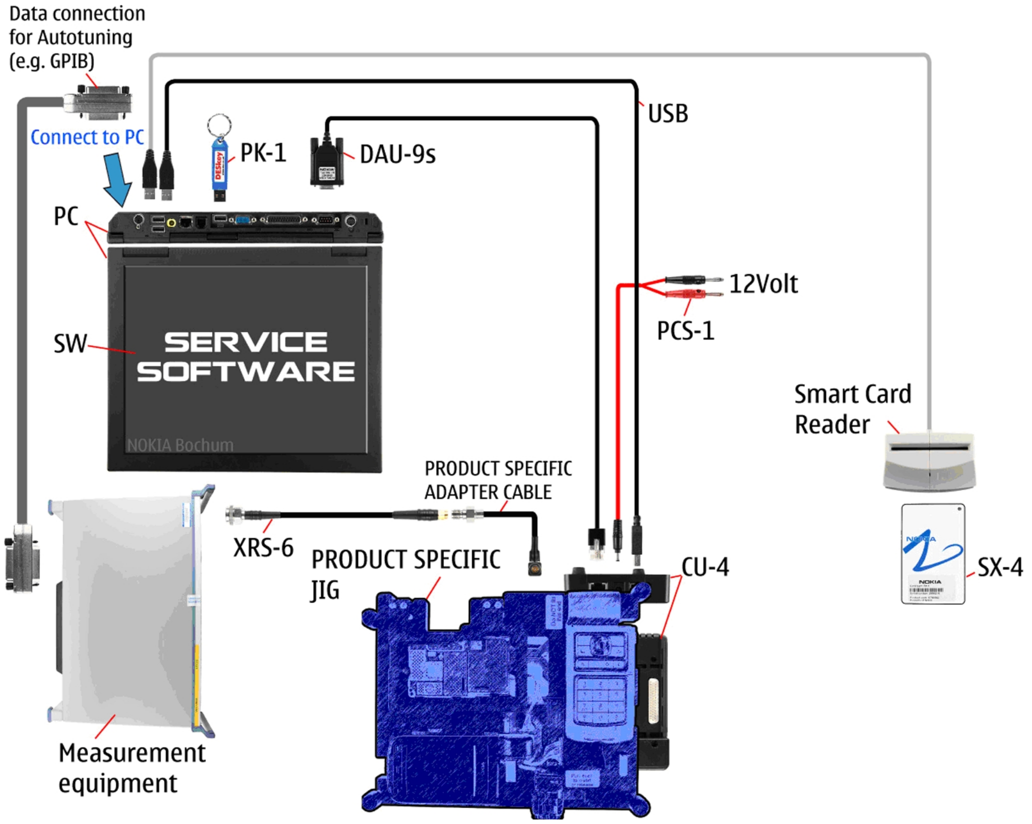
RF testing concept with RF coupler


Data connection
for Autotuning
(e.g. GPIB)
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE
SOFTWARE
NOKIA Bochum
XCS-4
CU-4
SX-4
XRS-6
PRODUCT SPECIFIC
RF ADAPTER
TRANSCEIVER
SS-62
PRODUCT SPECIFIC
FLASH ADAPTER
Measurement
equipment

Type	Description
Product specific devices	
FS-57	Flash adapter
SA-130	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable

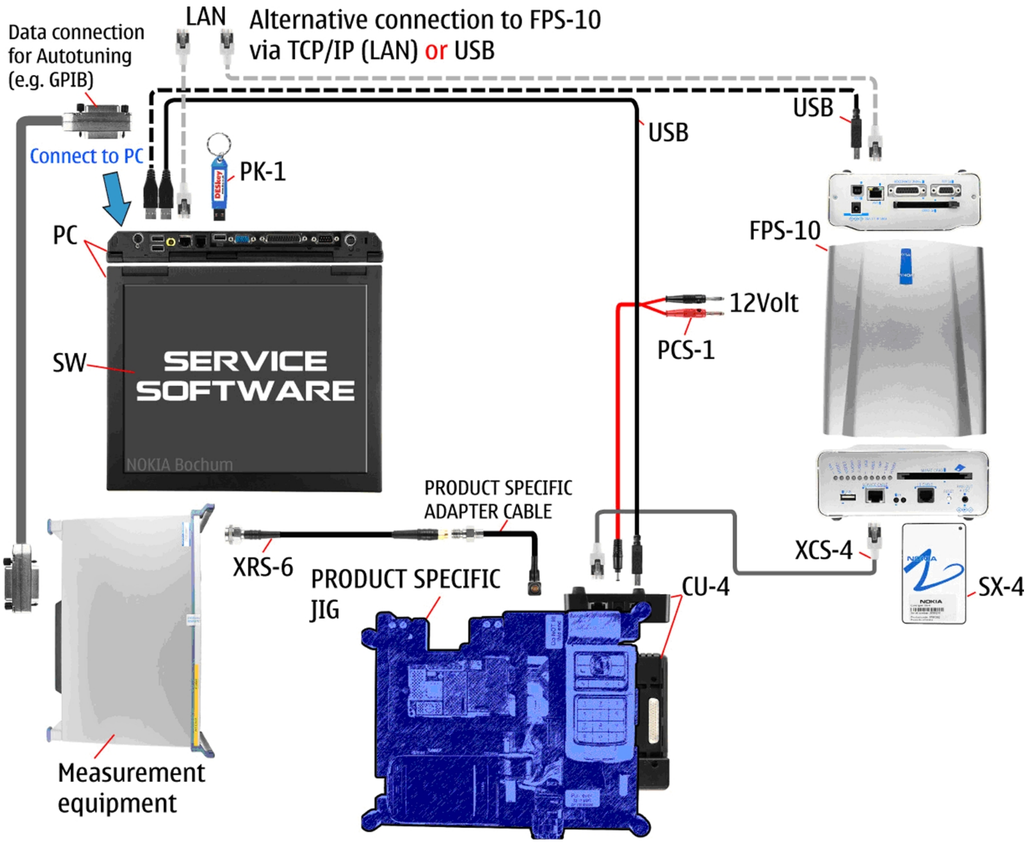
Type	Description
	USB cable

Module jig service concept with smart card reader


Data connection
for Autotuning
(e.g. GPIB)
Connect to PC
PK-1
DAU-9s
USB
PC
SW
SERVICE
SOFTWARE
NOKIA Bochum
12Volt
PCS-1
Smart Card
Reader
PRODUCT SPECIFIC
ADAPTER CABLE
XRS-6
PRODUCT SPECIFIC
JIG
CU-4
SX-4
Measurement
equipment

Type	Description
Product specific tools	
MJ-134	Module jig
Other tools	
CU-4	Control unit
PKD-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Smart card reader
Cables	
DAU-9S	MBUS cable
PCS-1	Power cable
XRS-6	RF cable
	USB cable

Module jig service concept


Data connection for Autotuning (e.g. GPIB)
LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC ADAPTER CABLE
XRS-6
PRODUCT SPECIFIC JIG
XCS-4
CU-4
SX-4
Measurement equipment

Type	Description
Phone specific devices	
MJ-134	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable
	GPIB control cable

3 — BB Troubleshooting and Manual Tuning Guide

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General BB troubleshooting guidelines

If any component is replaced, retest or rerun the selftest. If Betty (N2300) or Vilma (N2200) is replaced, perform an EM calibration.

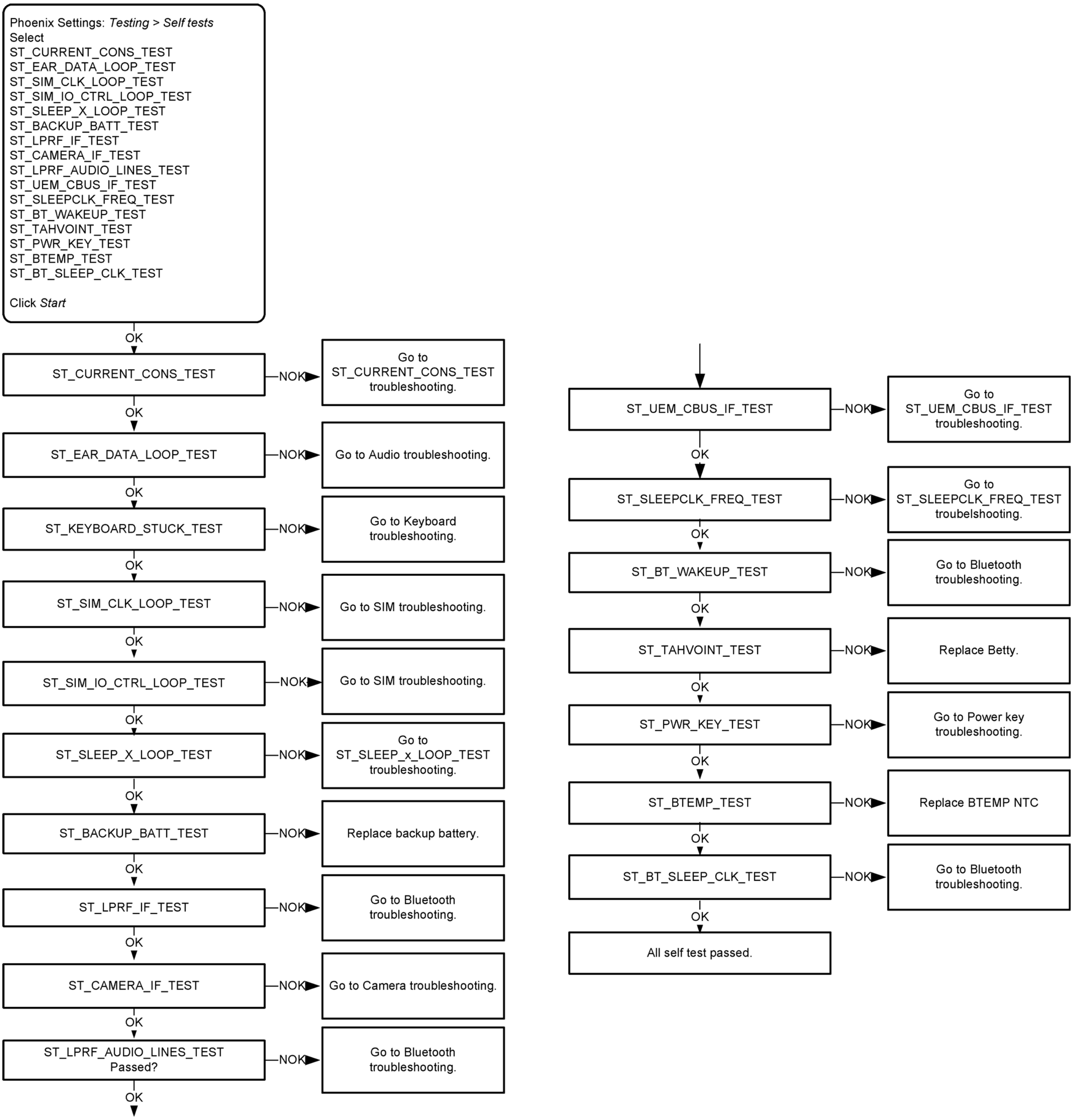
Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

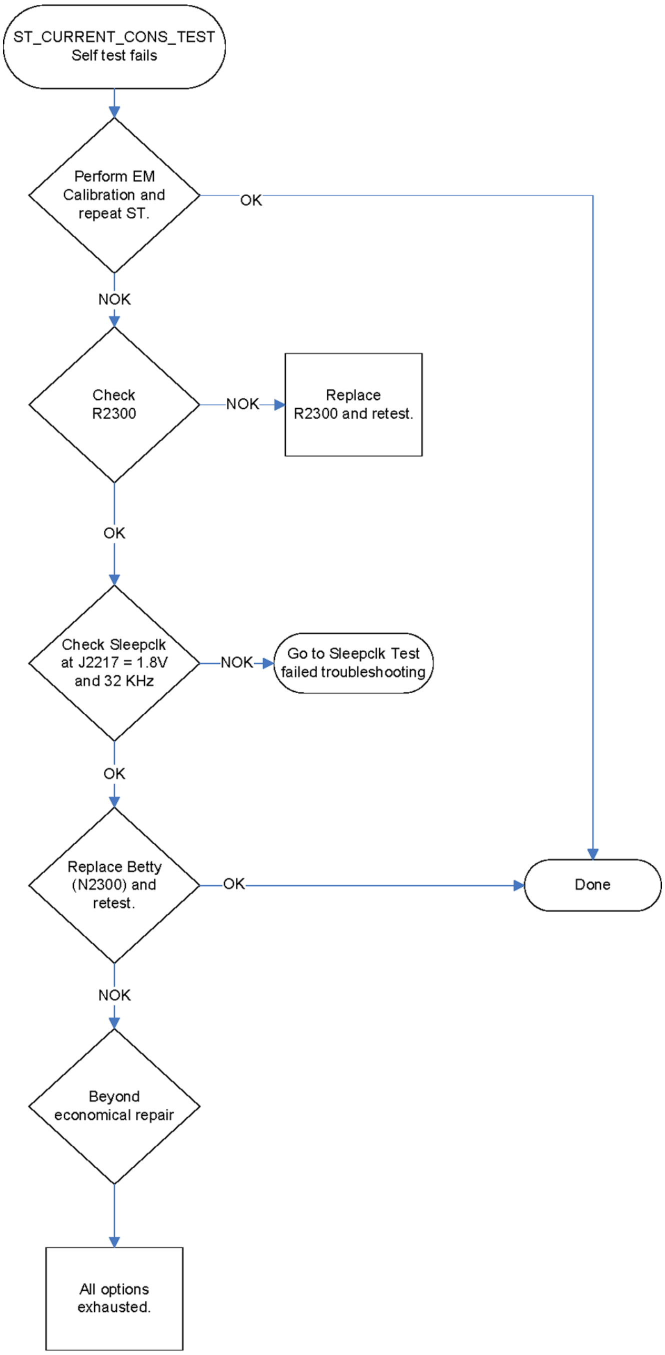
If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

Troubleshooting flow


Phoenix Settings: *Testing > Self tests*
Select
ST_CURRENT_CONS_TEST
ST_EAR_DATA_LOOP_TEST
ST_SIM_CLK_LOOP_TEST
ST_SIM_IO_CTRL_LOOP_TEST
ST_SLEEP_X_LOOP_TEST
ST_BACKUP_BATT_TEST
ST_LPRF_IF_TEST
ST_CAMERA_IF_TEST
ST_LPRF_AUDIO_LINES_TEST
ST_UEM_CBUS_IF_TEST
ST_SLEEPCLK_FREQ_TEST
ST_BT_WAKEUP_TEST
ST_TAHVOINT_TEST
ST_PWR_KEY_TEST
ST_BTEMP_TEST
ST_BT_SLEEP_CLK_TEST
Click *Start*
OK
ST_CURRENT_CONS_TEST
NOK
Go to ST_CURRENT_CONS_TEST troubleshooting.
OK
ST_EAR_DATA_LOOP_TEST
NOK
Go to Audio troubleshooting.
OK
ST_KEYBOARD_STUCK_TEST
NOK
Go to Keyboard troubleshooting.
OK
ST_SIM_CLK_LOOP_TEST
NOK
Go to SIM troubleshooting.
OK
ST_SIM_IO_CTRL_LOOP_TEST
NOK
Go to SIM troubleshooting.
OK
ST_SLEEP_X_LOOP_TEST
NOK
Go to ST_SLEEP_x_LOOP_TEST troubleshooting.
OK
ST_BACKUP_BATT_TEST
NOK
Replace backup battery.
OK
ST_LPRF_IF_TEST
NOK
Go to Bluetooth troubleshooting.
OK
ST_CAMERA_IF_TEST
NOK
Go to Camera troubleshooting.
OK
ST_LPRF_AUDIO_LINES_TEST Passed?
NOK
Go to Bluetooth troubleshooting.
OK
ST_UEM_CBUS_IF_TEST
NOK
Go to ST_UEM_CBUS_IF_TEST troubleshooting.
OK
ST_SLEEPCLK_FREQ_TEST
NOK
Go to ST_SLEEPCLK_FREQ_TEST troubelshooting.
OK
ST_BT_WAKEUP_TEST
NOK
Go to Bluetooth troubleshooting.
OK
ST_TAHVOINT_TEST
NOK
Replace Betty.
OK
ST_PWR_KEY_TEST
NOK
Go to Power key troubleshooting.
OK
ST_BTEMP_TEST
NOK
Replace BTEMP NTC
OK
ST_BT_SLEEP_CLK_TEST
NOK
Go to Bluetooth troubleshooting.
OK
All self test passed.

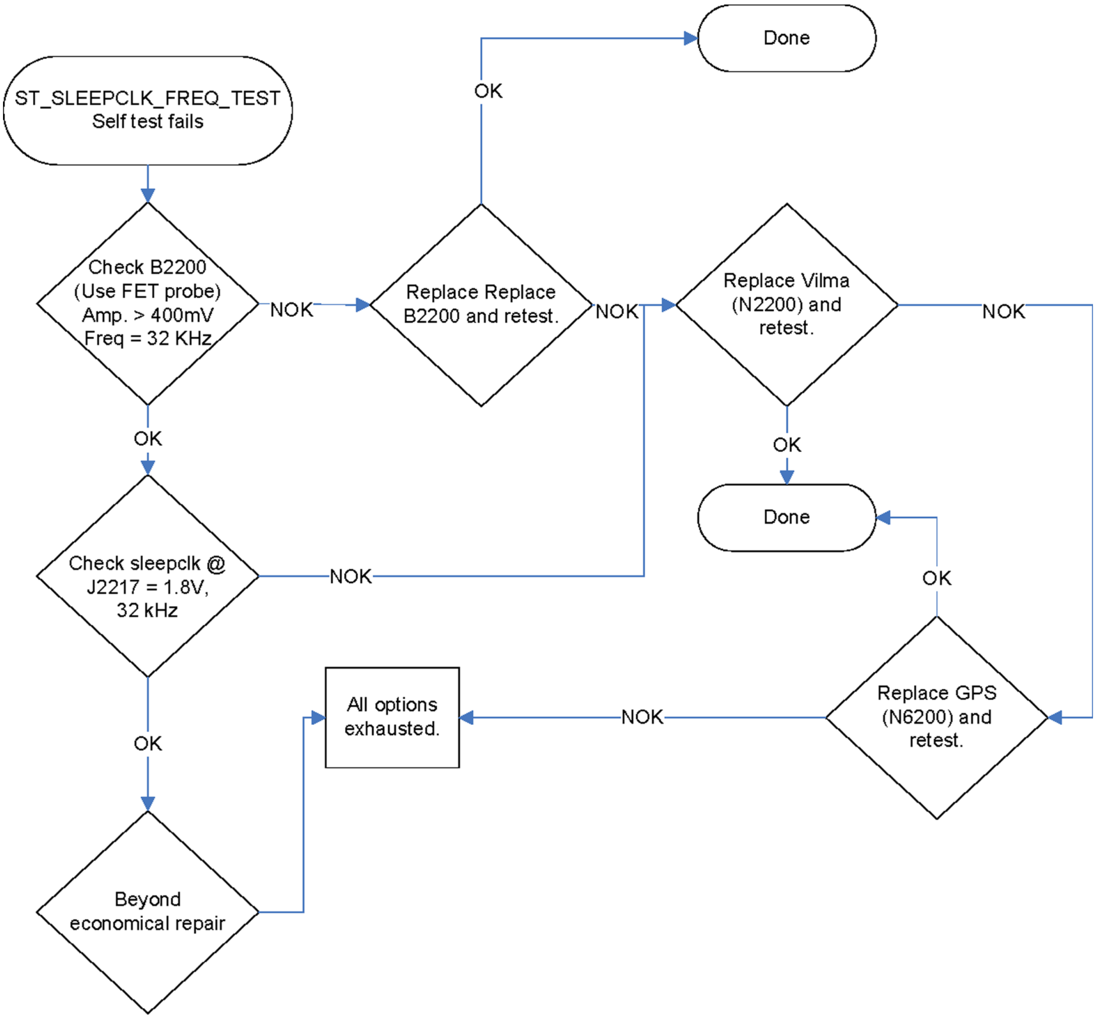
ST_CURRENT_CONS_TEST troubleshooting

Troubleshooting flow


ST_CURRENT_CONS_TEST
Self test fails
Perform EM Calibration and repeat ST.
OK
NOK
Check R2300
NOK
Replace R2300 and retest.
OK
Check Sleepclk at J2217 = 1.8V and 32 KHz
NOK
Go to Sleepclk Test failed troubleshooting
OK
Replace Betty (N2300) and retest.
OK
Done
NOK
Beyond economical repair
All options exhausted.

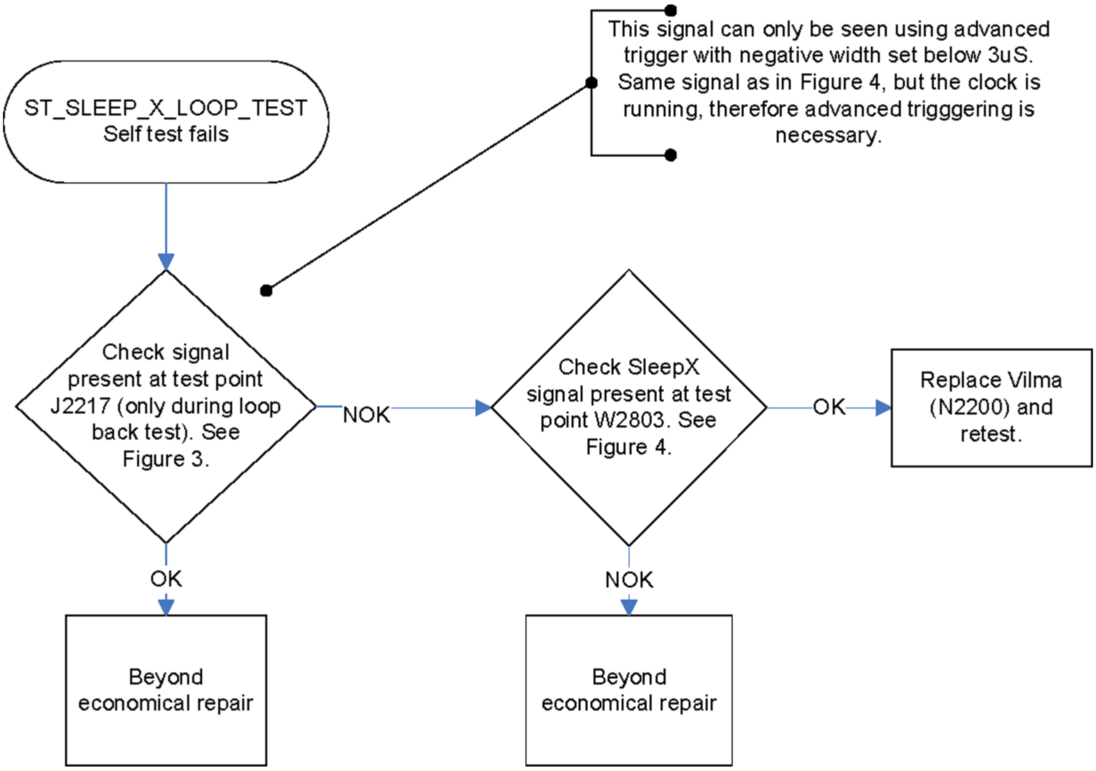
ST_SLEEPCLK_FREQ_TEST troubleshooting

Troubleshooting flow


ST_SLEEPCLK_FREQ_TEST
Self test fails
Check B2200
(Use FET probe)
Amp. > 400mV
Freq = 32 KHz
NOK
OK
Replace Replace
B2200 and retest.
OK
Done
NOK
Replace Vilma
(N2200) and
retest.
OK
Done
NOK
Check sleepclk @
J2217 = 1.8V,
32 kHz
NOK
OK
Beyond
economical repair
All options
exhausted.
NOK
Replace GPS
(N6200) and
retest.
OK

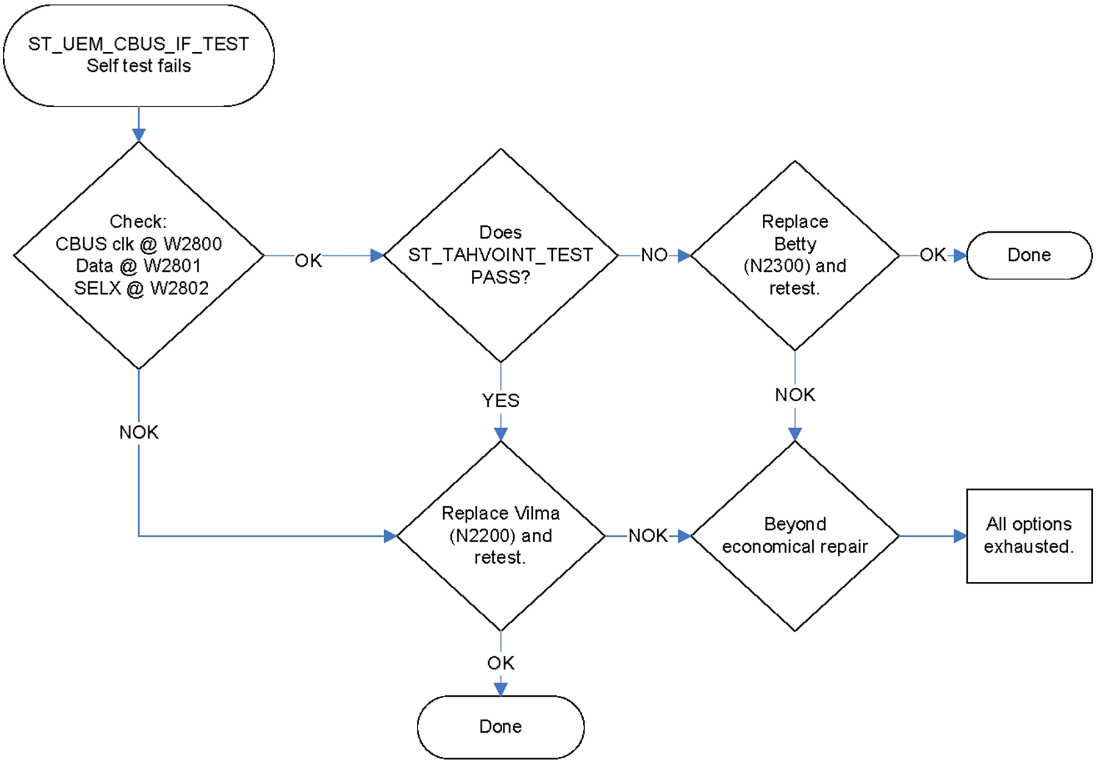
ST_SLEEP_X_LOOP_TEST troubleshooting

Troubleshooting flow


This signal can only be seen using advanced trigger with negative width set below 3uS. Same signal as in Figure 4, but the clock is running, therefore advanced trigggering is necessary.
ST_SLEEP_X_LOOP_TEST Self test fails
Check signal present at test point J2217 (only during loop back test). See Figure 3.
NOK
Check SleepX signal present at test point W2803. See Figure 4.
OK
Replace Vilma (N2200) and retest.
OK
Beyond economical repair
NOK
Beyond economical repair

ST_UEM_CBUS_IF_TEST troubleshooting

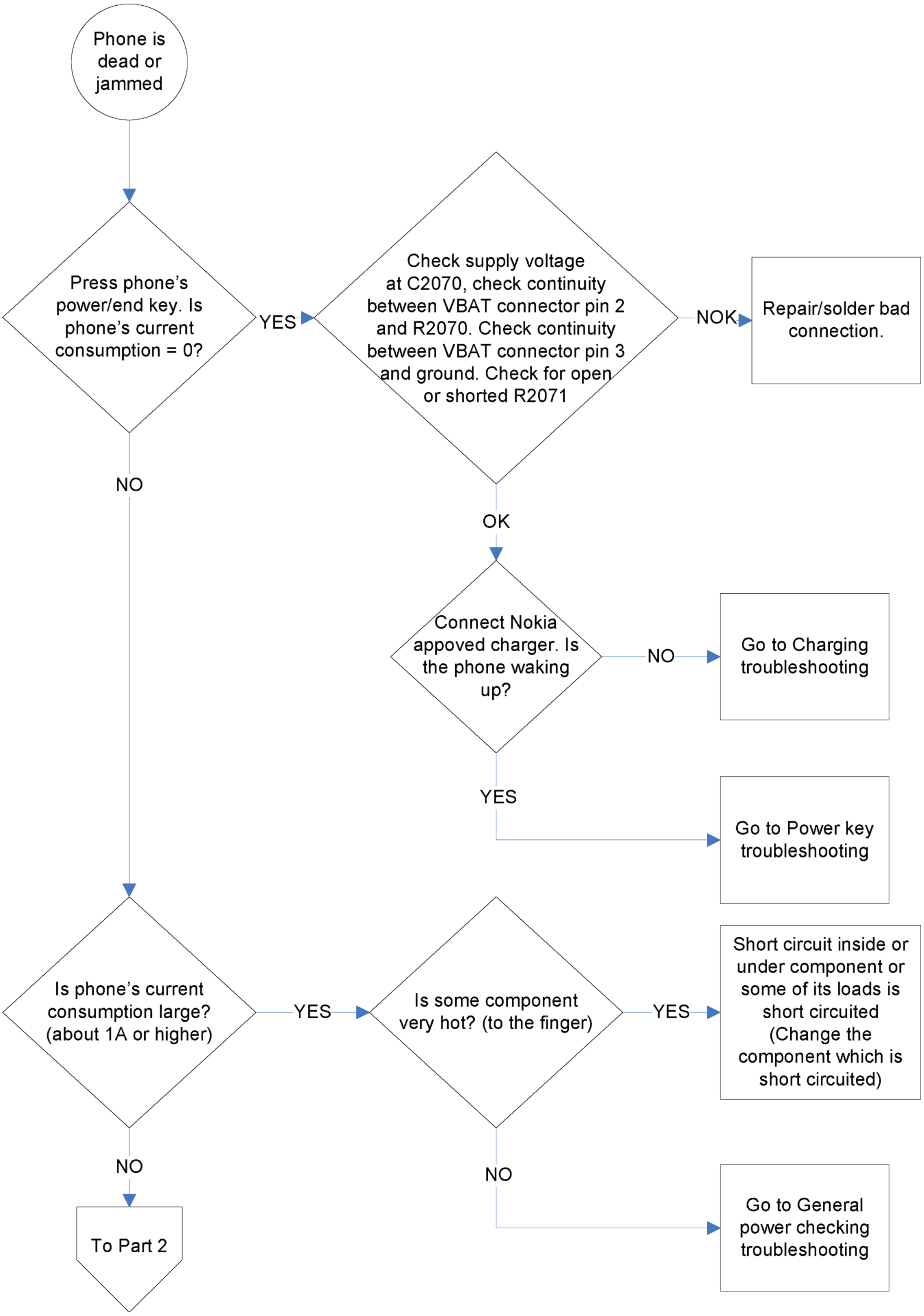
Troubleshooting flow


ST_UEM_CBUS_IF_TEST
Self test fails
Check:
CBUS clk @ W2800
Data @ W2801
SELX @ W2802
OK
Does
ST_TAHVOINT_TEST
PASS?
NO
Replace
Betty
(N2300) and
retest.
OK
Done
NOK
YES
NOK
Replace Vilma
(N2200) and
retest.
NOK
Beyond
economical repair
All options
exhausted.
OK
Done

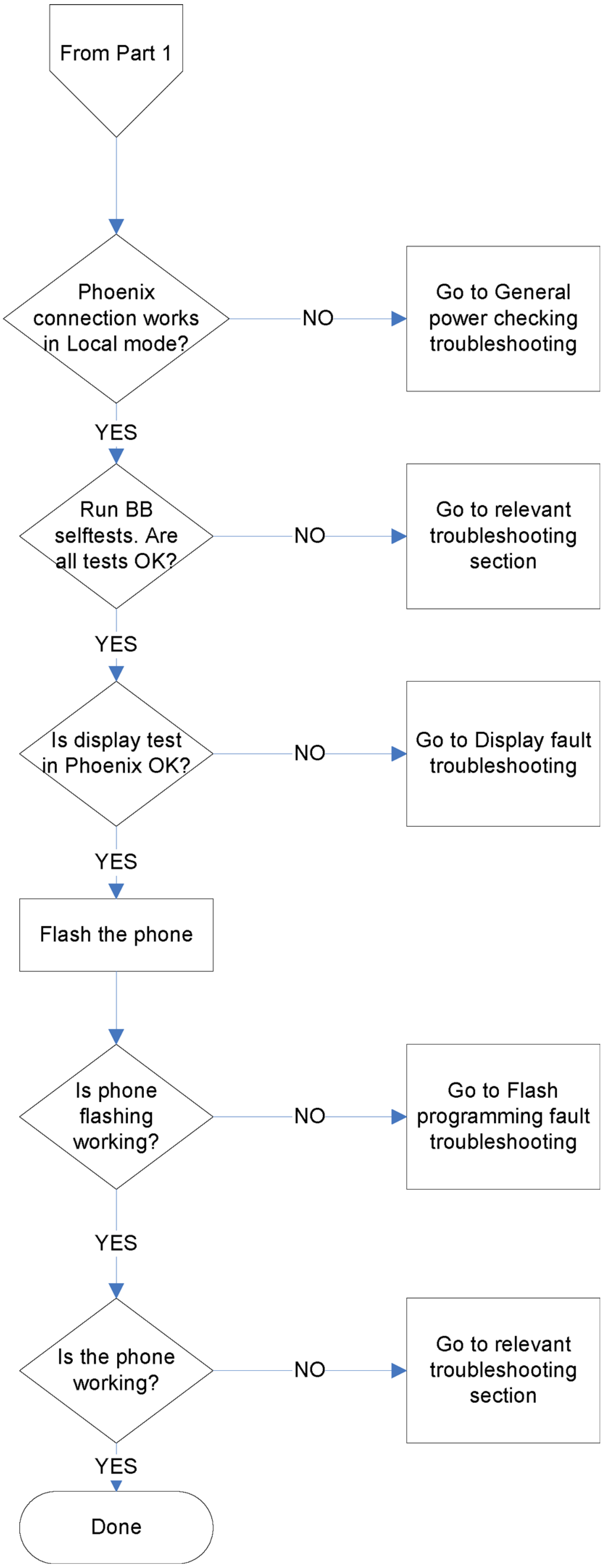
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power/end key. Is phone's current consumption = 0?
YES
Check supply voltage at C2070, check continuity between VBAT connector pin 2 and R2070. Check continuity between VBAT connector pin 3 and ground. Check for open or shorted R2071
NOK
Repair/solder bad connection.
OK
Connect Nokia appoved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under component or some of its loads is short circuited (Change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO
To Part 2

Troubleshooting flow


From Part 1
Phoenix connection works in Local mode?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
Done

General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, IrDA, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.8	Display & hall sensor	
VANA	AVILMA	ON	ON	2.5	Audio, some pull-ups	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators	
VRFC	AVILMA	OFF	ON	1.8	RAP3G converters	
VRCP1	AVILMA	OFF	OFF	4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 1.25 1.35 1.40	RAP3G digital	
VOUT	BETTY	OFF	OFF	2.5	Not used	Accessory connected
V2.8	TK63128B-G	OFF	OFF	2.850	Camera	Disabled in sleep
VDIG	LM3677	OFF	OFF	1.800	Camera	Disabled in sleep
VSD	LP3929TMEX	OFF	OFF	2.850	MicroSD card	Disabled in sleep
VLED1	TK11891F-G	OFF	OFF	6.2V	Main LCD Backlight	Disabled in sleep
VLED2	TK11891F-G	OFF	OFF	6.0V	2nd LCD Backlight	Disabled in sleep

See the following figure for the power up timing.

Power up procedure

Power up procedure starts when the user presses and holds the power/end key.

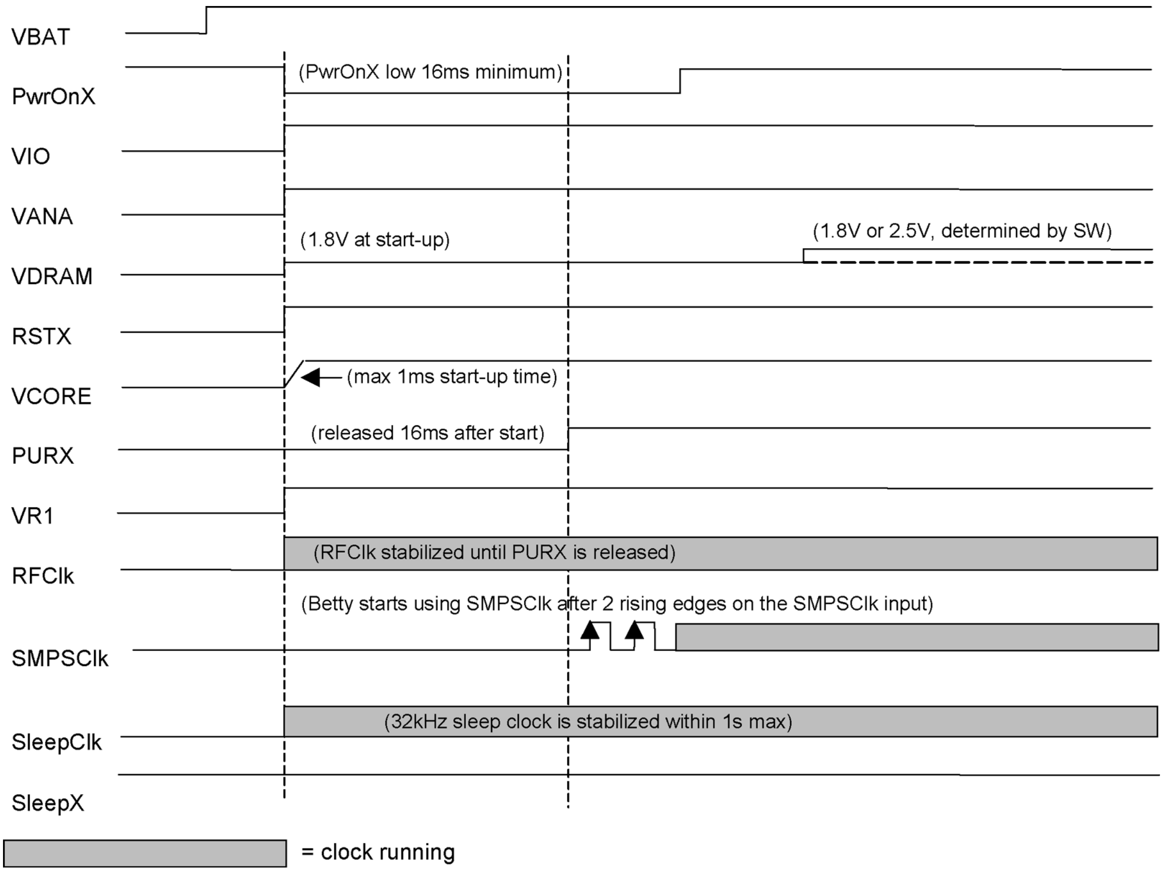

VBAT
PwrOnX
(PwrOnX low 16ms minimum)
VIO
VANA
(1.8V at start-up)
(1.8V or 2.5V, determined by SW)
VDRAM
RSTX
VCORE
(max 1ms start-up time)
PURX
(released 16ms after start)
VR1
RFClk
(RFClk stabilized until PURX is released)
(Betty starts using SMPSClk after 2 rising edges on the SMPSClk input)
SMPSClk
SleepClk
(32kHz sleep clock is stabilized within 1s max)
SleepX
= clock running

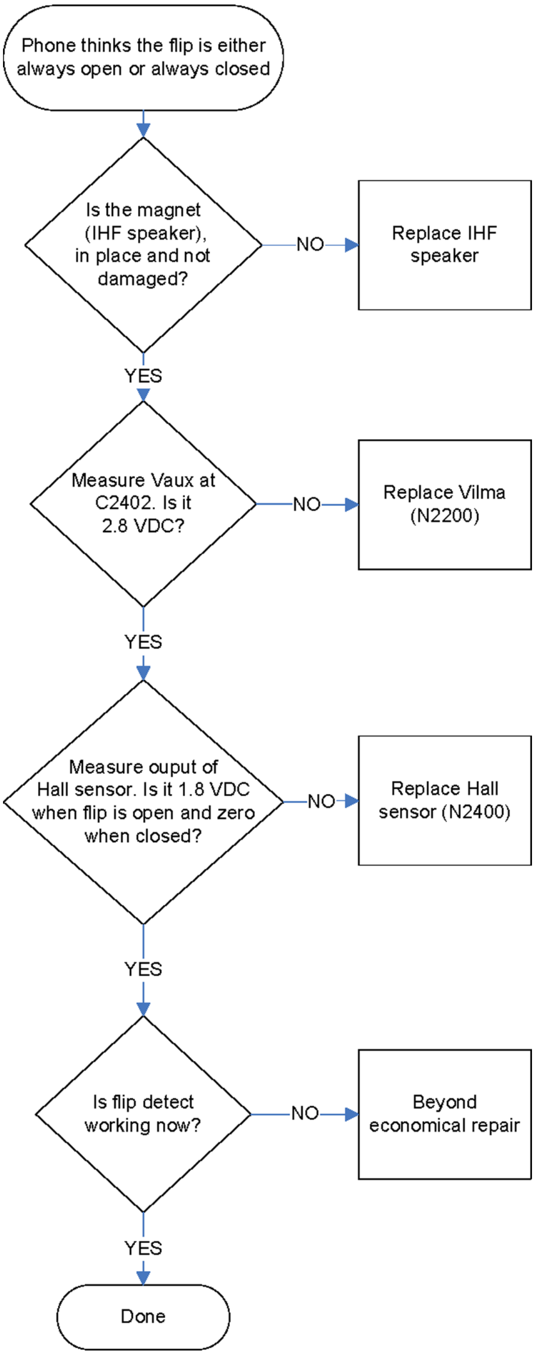
Figure 3 Power up timing

1. User presses the power/end key -> PWRONX is low.
2. Vilma activates Vana, VIO, VDRAM (1.8V), sleep oscillator and VR1 -> VCTCXO starts running, Digital ASIC gets system clock, I/O buffers are powered, FLASH devices are powered. Vilma raises RstX signal to Betty.
3. Betty starts Vcore regulator immediately when RstX rises. Due to soft start this however may take up to 1 ms.
4. RF clock is stable.
5. After 16 ms Vilma releases PURX -> Digital ASICs start their boot sequence. RAP3G can switch SW controlled regulators on/off, RAP3G controls sleeping by SleepX signal.
6. RAP3G is powered up.

Note: SleepX signal is raised at the beginning of start up procedure and it does not go to zero before system is really ready to go to sleep. This differs from behaviour in previous generations.

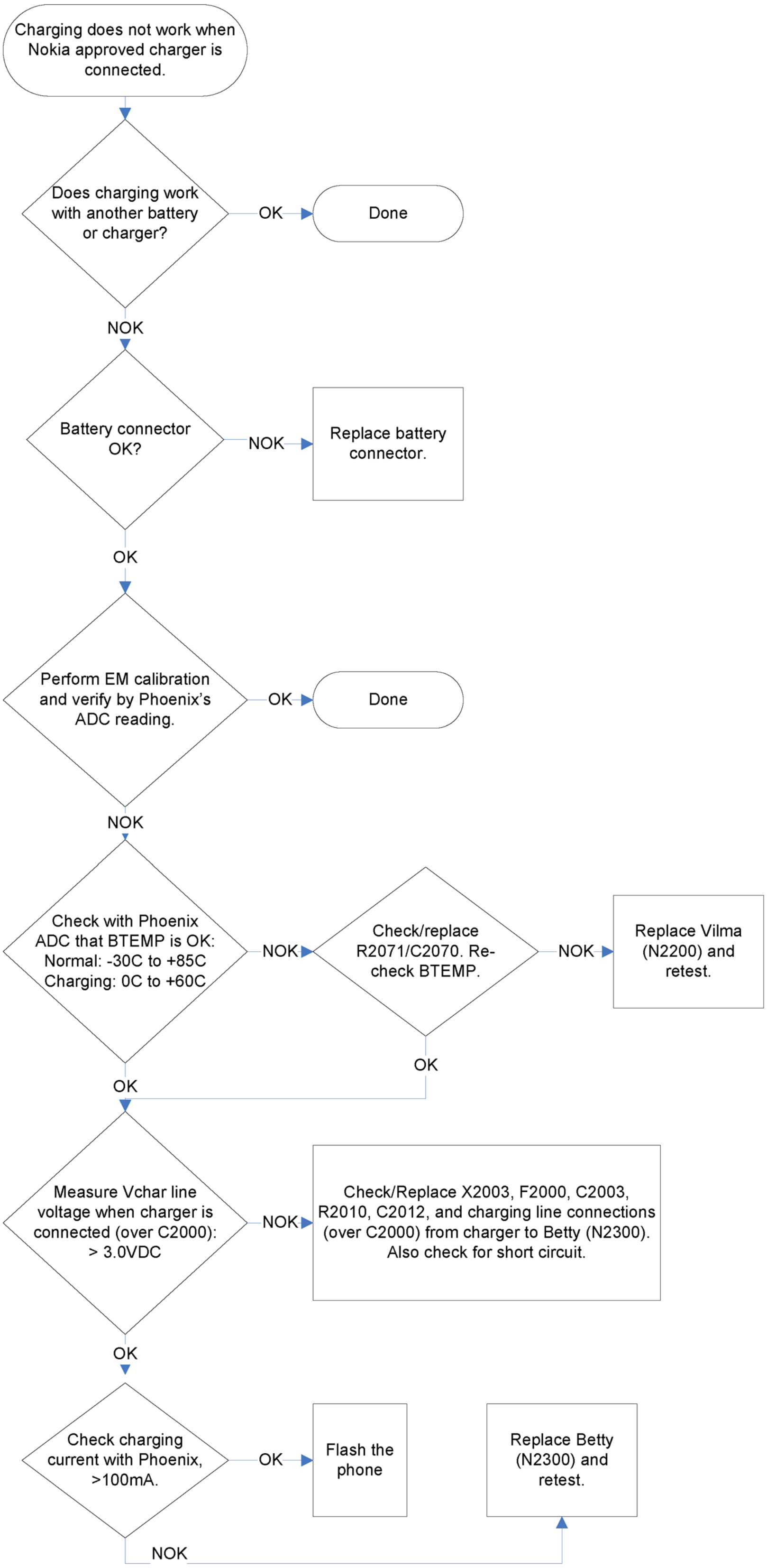
Hall sensor troubleshooting

Troubleshooting flow


Phone thinks the flip is either always open or always closed
Is the magnet (IHF speaker), in place and not damaged?
NO
Replace IHF speaker
YES
Measure Vaux at C2402. Is it 2.8 VDC?
NO
Replace Vilma (N2200)
YES
Measure ouput of Hall sensor. Is it 1.8 VDC when flip is open and zero when closed?
NO
Replace Hall sensor (N2400)
YES
Is flip detect working now?
NO
Beyond economical repair
YES
Done

Charging troubleshooting

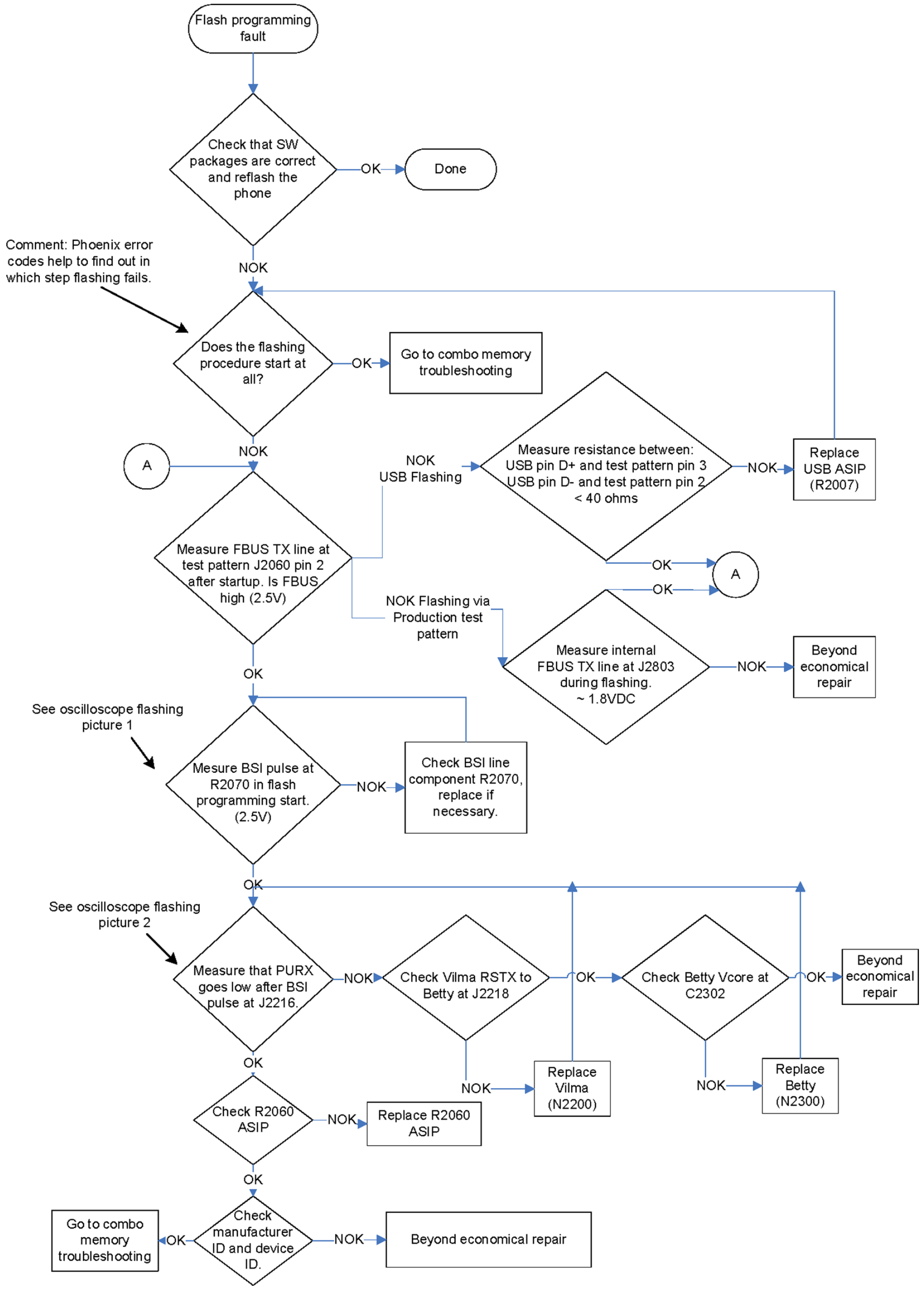
Troubleshooting flow


Charging does not work when Nokia approved charger is connected.
Does charging work with another battery or charger?
OK
Done
NOK
Battery connector OK?
NOK
Replace battery connector.
OK
Perform EM calibration and verify by Phoenix's ADC reading.
OK
Done
NOK
Check with Phoenix ADC that BTEMP is OK: Normal: -30C to +85C Charging: 0C to +60C
NOK
Check/replace R2071/C2070. Re-check BTEMP.
NOK
Replace Vilma (N2200) and retest.
OK
OK
Measure Vchar line voltage when charger is connected (over C2000): > 3.0VDC
NOK
Check/Replace X2003, F2000, C2003, R2010, C2012, and charging line connections (over C2000) from charger to Betty (N2300). Also check for short circuit.
OK
Check charging current with Phoenix, >100mA.
OK
Flash the phone
Replace Betty (N2300) and retest.
NOK

Interface troubleshooting

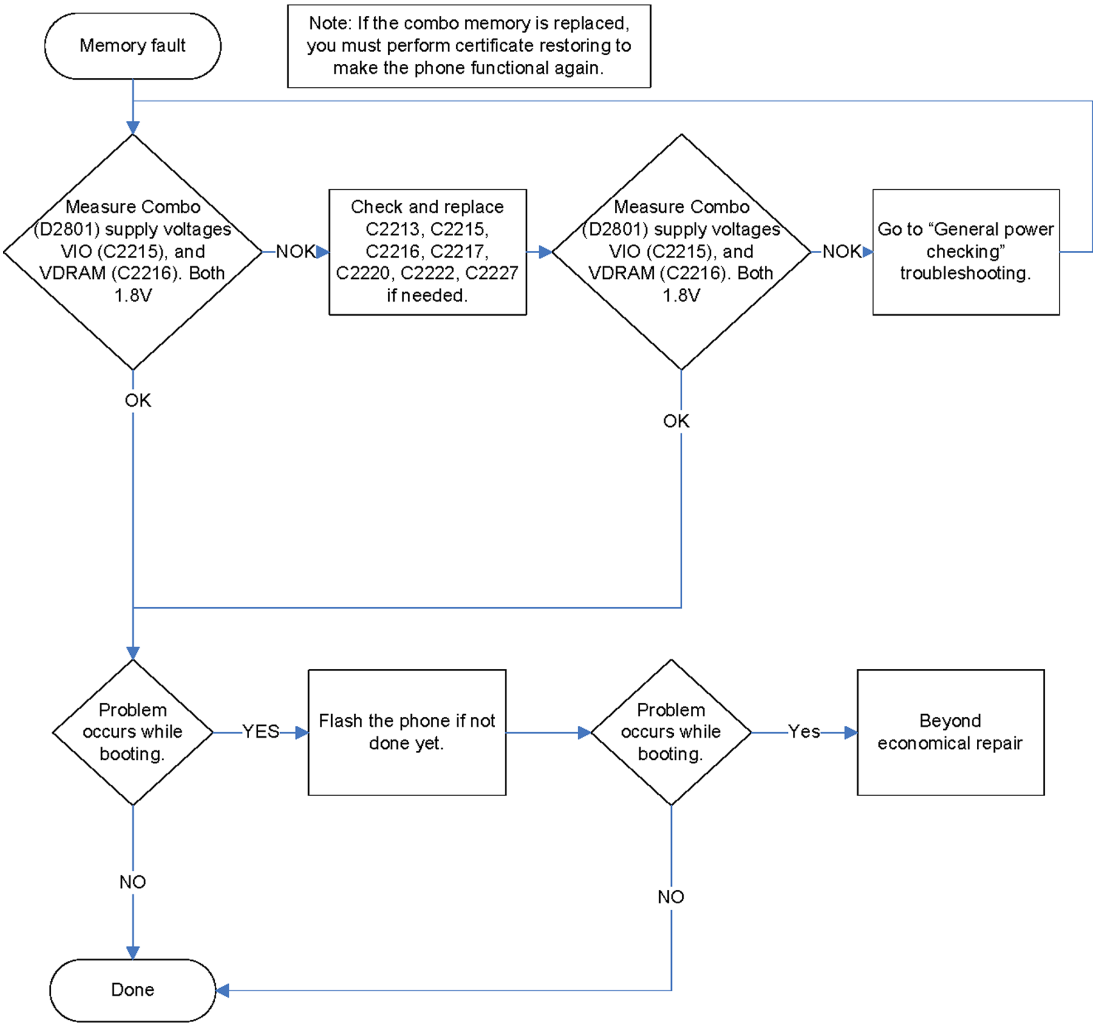
Flash programming fault troubleshooting

Troubleshooting flow


Flash programming fault
Check that SW packages are correct and reflash the phone
OK
Done
NOK
Comment: Phoenix error codes help to find out in which step flashing fails.
Does the flashing procedure start at all?
OK
Go to combo memory troubleshooting
NOK
A
NOK USB Flashing
Measure resistance between: USB pin D+ and test pattern pin 3 USB pin D- and test pattern pin 2 < 40 ohms
NOK
Replace USB ASIP (R2007)
OK
A
Measure FBUS TX line at test pattern J2060 pin 2 after startup. Is FBUS high (2.5V)
NOK Flashing via Production test pattern
OK
Measure internal FBUS TX line at J2803 during flashing. ~ 1.8VDC
NOK
Beyond economical repair
OK
See oscilloscope flashing picture 1
Mesure BSI pulse at R2070 in flash programming start. (2.5V)
NOK
Check BSI line component R2070, replace if necessary.
OK
See oscilloscope flashing picture 2
Measure that PURX goes low after BSI pulse at J2216.
NOK
Check Vilma RSTX to Betty at J2218
OK
Check Betty Vcore at C2302
OK
Beyond economical repair
NOK
Replace Vilma (N2200)
NOK
Replace Betty (N2300)
OK
Check R2060 ASIP
NOK
Replace R2060 ASIP
OK
Go to combo memory troubleshooting
OK
Check manufacturer ID and device ID.
NOK
Beyond economical repair

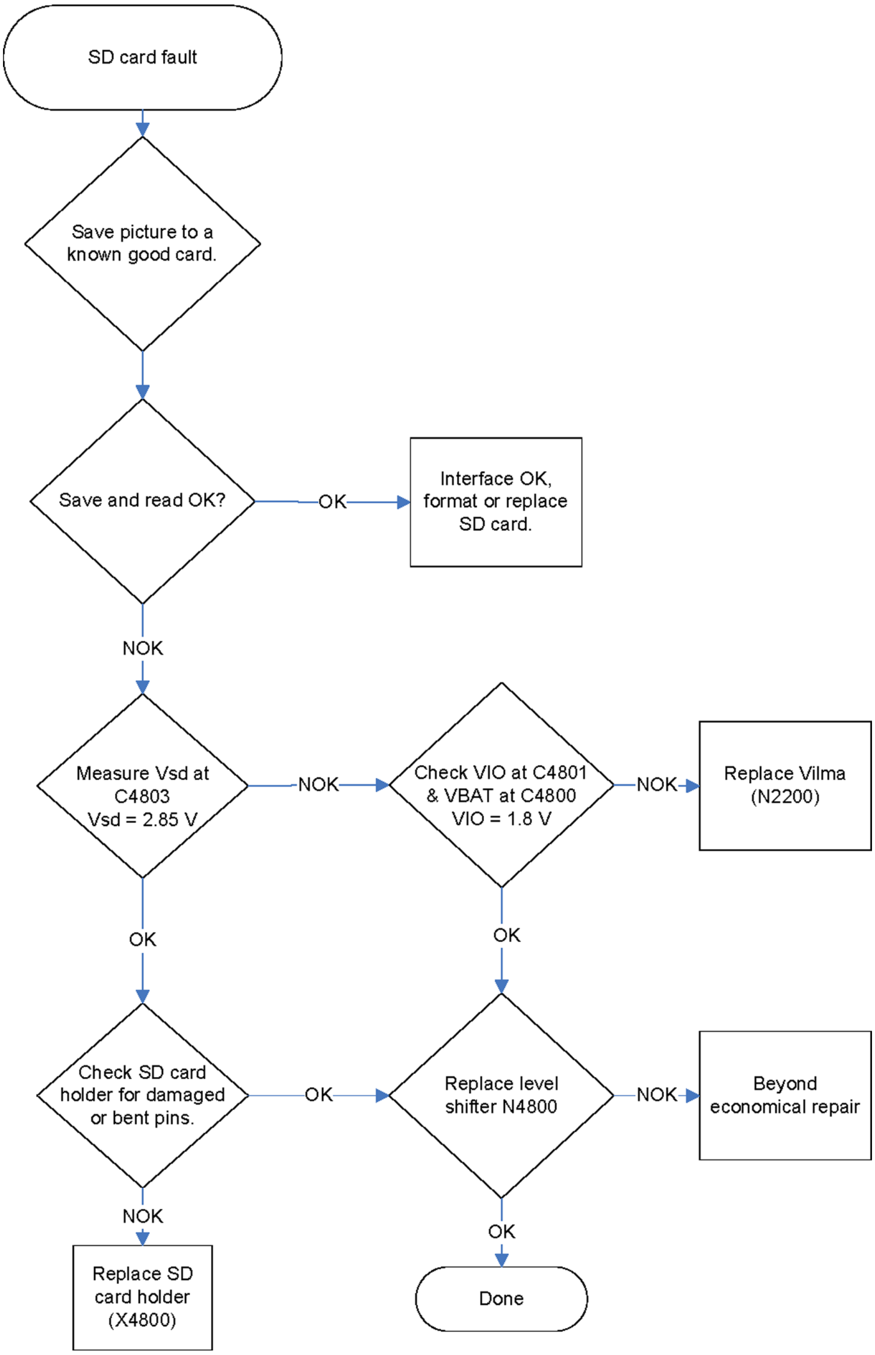
Combo memory troubleshooting

Troubleshooting flow


Memory fault
Note: If the combo memory is replaced, you must perform certificate restoring to make the phone functional again.
Measure Combo (D2801) supply voltages VIO (C2215), and VDRAM (C2216). Both 1.8V
NOK
Check and replace C2213, C2215, C2216, C2217, C2220, C2222, C2227 if needed.
Measure Combo (D2801) supply voltages VIO (C2215), and VDRAM (C2216). Both 1.8V
NOK
Go to “General power checking” troubleshooting.
OK
OK
Problem occurs while booting.
YES
Flash the phone if not done yet.
Problem occurs while booting.
Yes
Beyond economical repair
NO
NO
Done

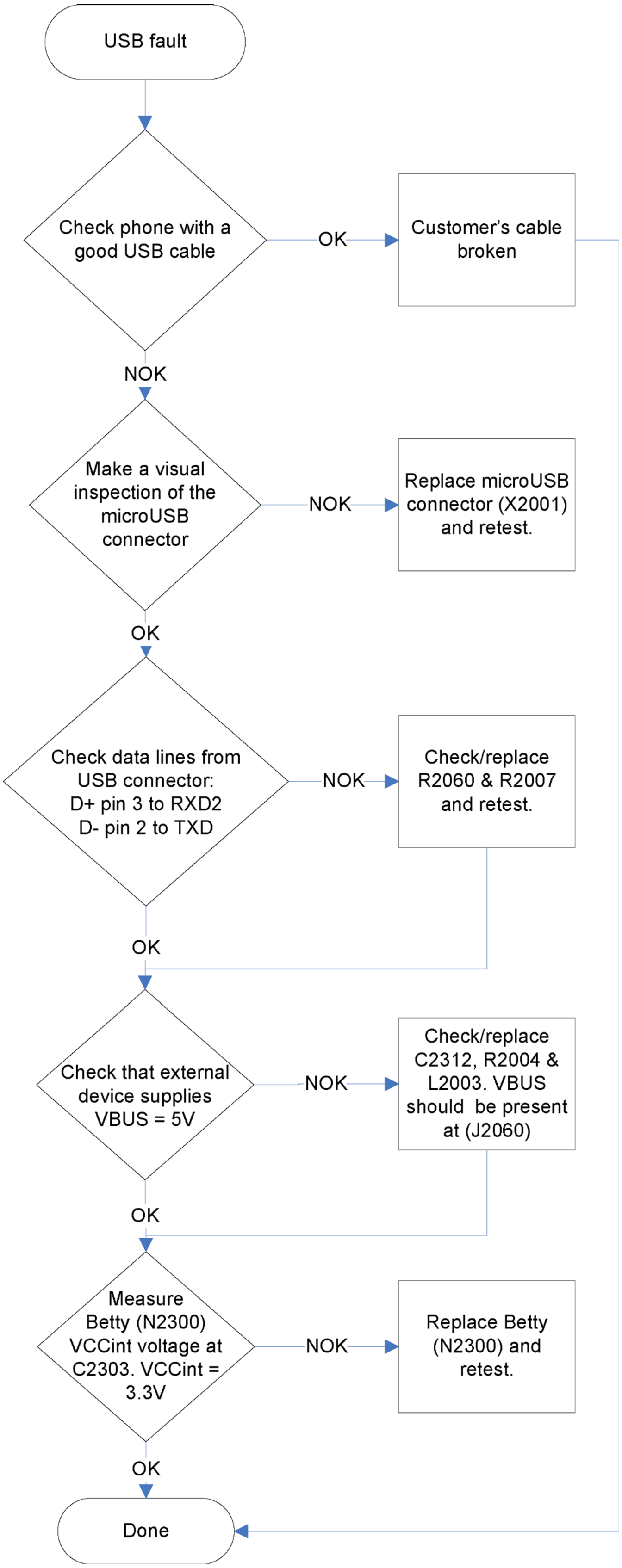
SD card troubleshooting

Troubleshooting flow


SD card fault
Save picture to a known good card.
Save and read OK?
OK
Interface OK, format or replace SD card.
NOK
Measure Vsd at C4803 Vsd = 2.85 V
NOK
Check VIO at C4801 & VBAT at C4800 VIO = 1.8 V
NOK
Replace Vilma (N2200)
OK
OK
Check SD card holder for damaged or bent pins.
OK
Replace level shifter N4800
NOK
Beyond economical repair
NOK
Replace SD card holder (X4800)
OK
Done

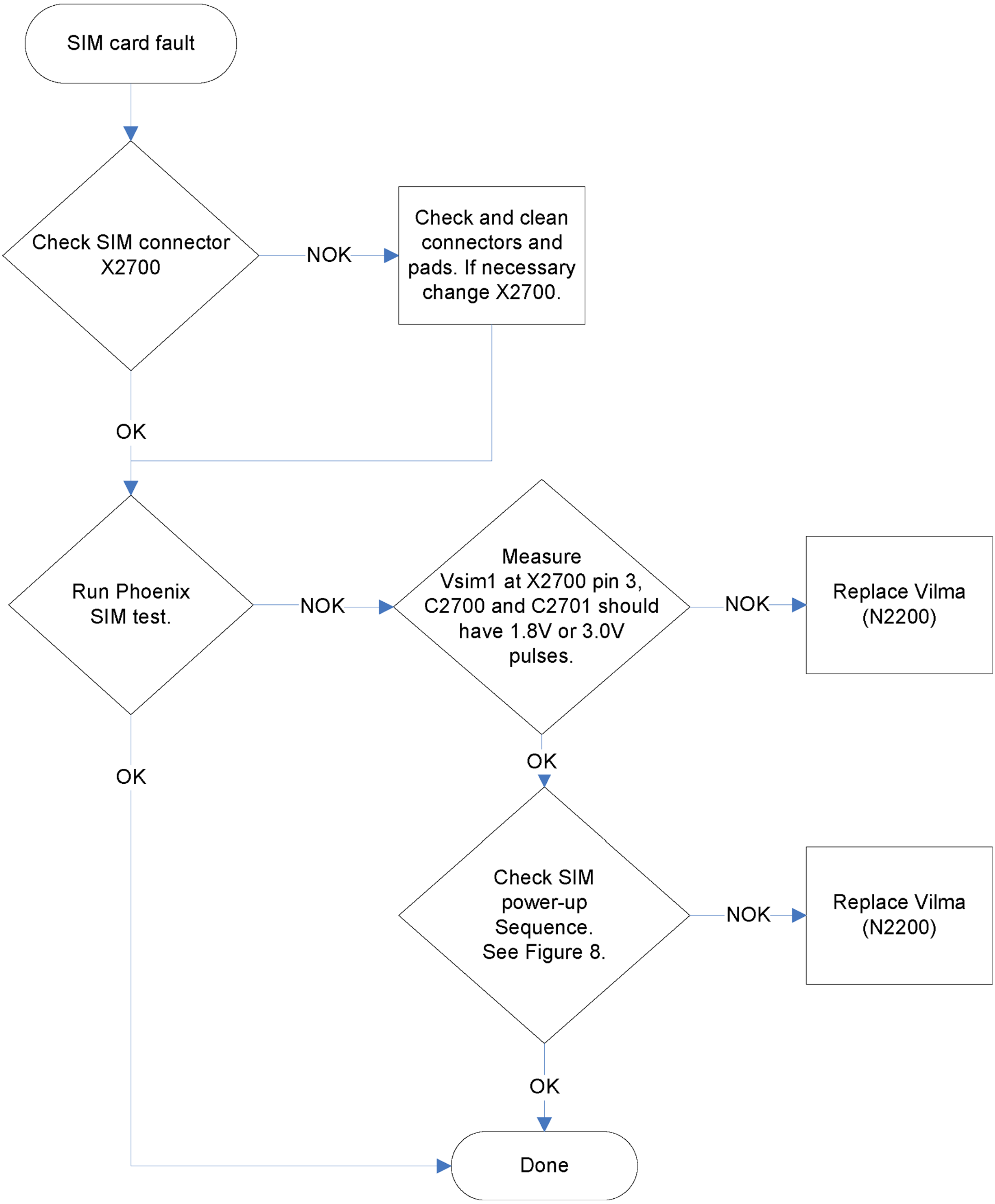
USB interface troubleshooting

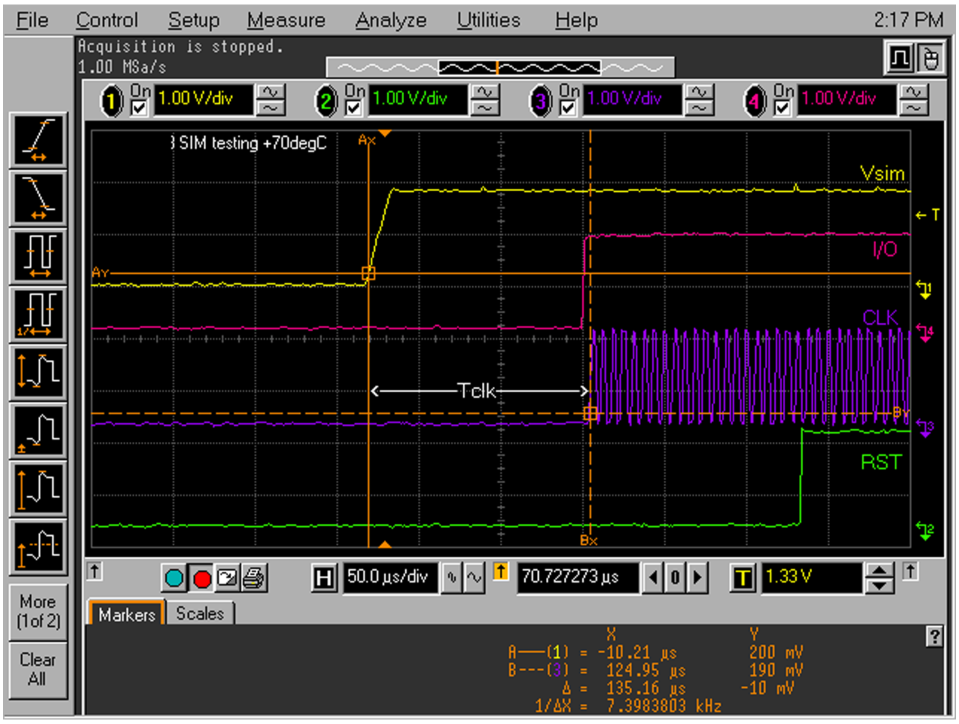
Troubleshooting flow


USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the microUSB connector
NOK
Replace microUSB connector (X2001) and retest.
OK
Check data lines from USB connector: D+ pin 3 to RXD2 D- pin 2 to TXD
NOK
Check/replace R2060 & R2007 and retest.
OK
Check that external device supplies VBUS = 5V
NOK
Check/replace C2312, R2004 & L2003. VBUS should be present at (J2060)
OK
Measure Betty (N2300) VCCint voltage at C2303. VCCint = 3.3V
NOK
Replace Betty (N2300) and retest.
OK
Done

SIM card troubleshooting

Troubleshooting flow


SIM card fault
Check SIM connector X2700
NOK
Check and clean connectors and pads. If necessary change X2700.
OK
Run Phoenix SIM test.
NOK
Measure Vsim1 at X2700 pin 3, C2700 and C2701 should have 1.8V or 3.0V pulses.
NOK
Replace Vilma (N2200)
OK
OK
Check SIM power-up Sequence. See Figure 8.
NOK
Replace Vilma (N2200)
OK
Done


File
Control
Setup
Measure
Analyze
Utilities
Help
2:17 PM
1.00 V/div
1.00 V/div
1.00 V/div
1.00 V/div
SIM testing +70degC
Ax
Ay
Vsim
I/O
CLK
Tclk
By
RST
Bx
More (1 of 2)
Clear All
Markers
Scales
50.0 µs/div
70.727273 µs
1.33 V

```
Acquisition is stopped.
1.00 MSa/s
```

```
              X               Y
A——(1) = -10.21 µs         200 mV
B---(3) =  124.95 µs       190 mV
      Δ =  135.16 µs       -10 mV
   1/ΔX =  7.3983803 kHz
```

Figure 4 SIM power-up sequence

User interface troubleshooting

Keyboard troubleshooting

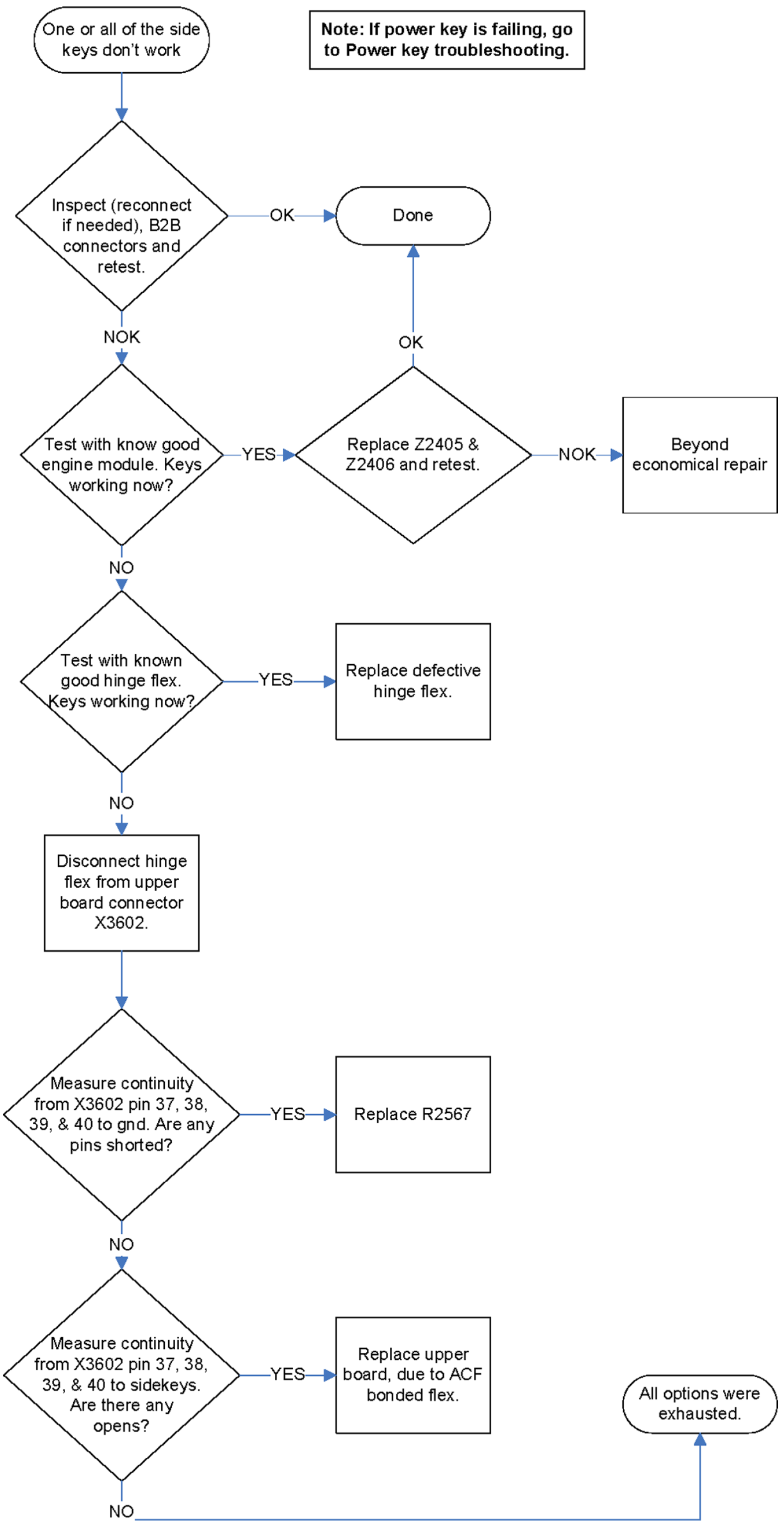
Context

There are two possible failure modes in the keyboard module:

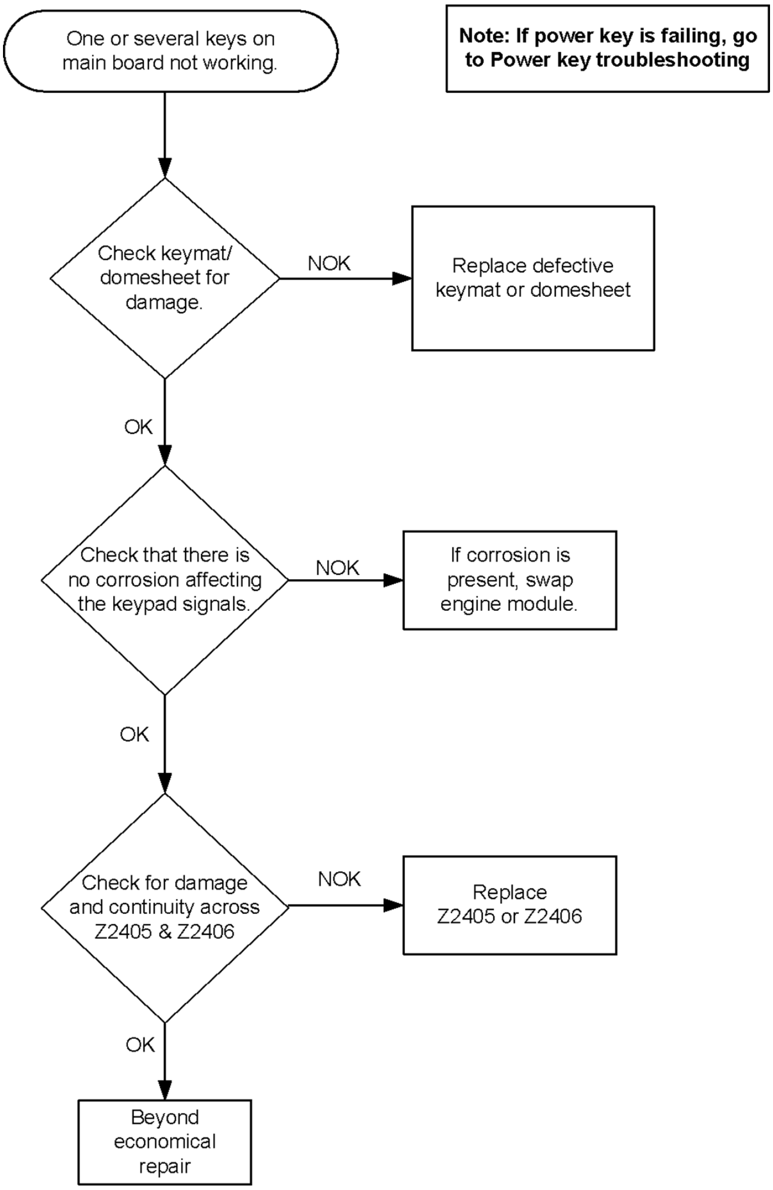
- One or more keys are stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt or corrosion).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection).

If the failure mode is not clear, start with the Keyboard test in Phoenix.

Side keys troubleshooting

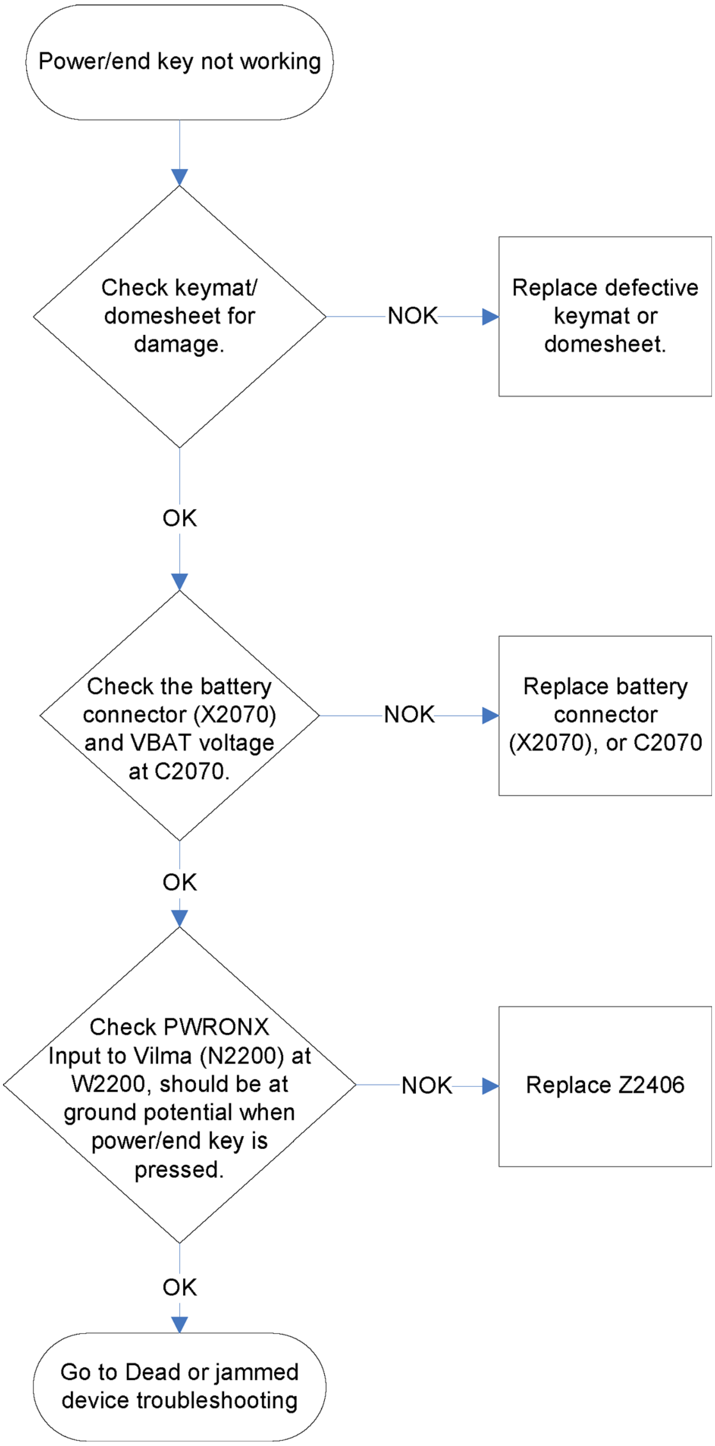

One or all of the side keys don't work
Note: If power key is failing, go to Power key troubleshooting.
Inspect (reconnect if needed), B2B connectors and retest.
OK
Done
NOK
OK
Test with know good engine module. Keys working now?
YES
Replace Z2405 & Z2406 and retest.
NOK
Beyond economical repair
NO
Test with known good hinge flex. Keys working now?
YES
Replace defective hinge flex.
NO
Disconnect hinge flex from upper board connector X3602.
Measure continuity from X3602 pin 37, 38, 39, & 40 to gnd. Are any pins shorted?
YES
Replace R2567
NO
Measure continuity from X3602 pin 37, 38, 39, & 40 to sidekeys. Are there any opens?
YES
Replace upper board, due to ACF bonded flex.
All options were exhausted.
NO

Keys troubleshooting


One or several keys on main board not working.
Note: If power key is failing, go to Power key troubleshooting
Check keymat/ domesheet for damage.
NOK
Replace defective keymat or domesheet
OK
Check that there is no corrosion affecting the keypad signals.
NOK
If corrosion is present, swap engine module.
OK
Check for damage and continuity across Z2405 & Z2406
NOK
Replace Z2405 or Z2406
OK
Beyond economical repair

Power/end key troubleshooting

Troubleshooting flow


Power/end key not working
Check keymat/ domesheet for damage.
NOK
Replace defective keymat or domesheet.
OK
Check the battery connector (X2070) and VBAT voltage at C2070.
NOK
Replace battery connector (X2070), or C2070
OK
Check PWRONX Input to Vilma (N2200) at W2200, should be at ground potential when power/end key is pressed.
NOK
Replace Z2406
OK
Go to Dead or jammed device troubleshooting

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 8 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

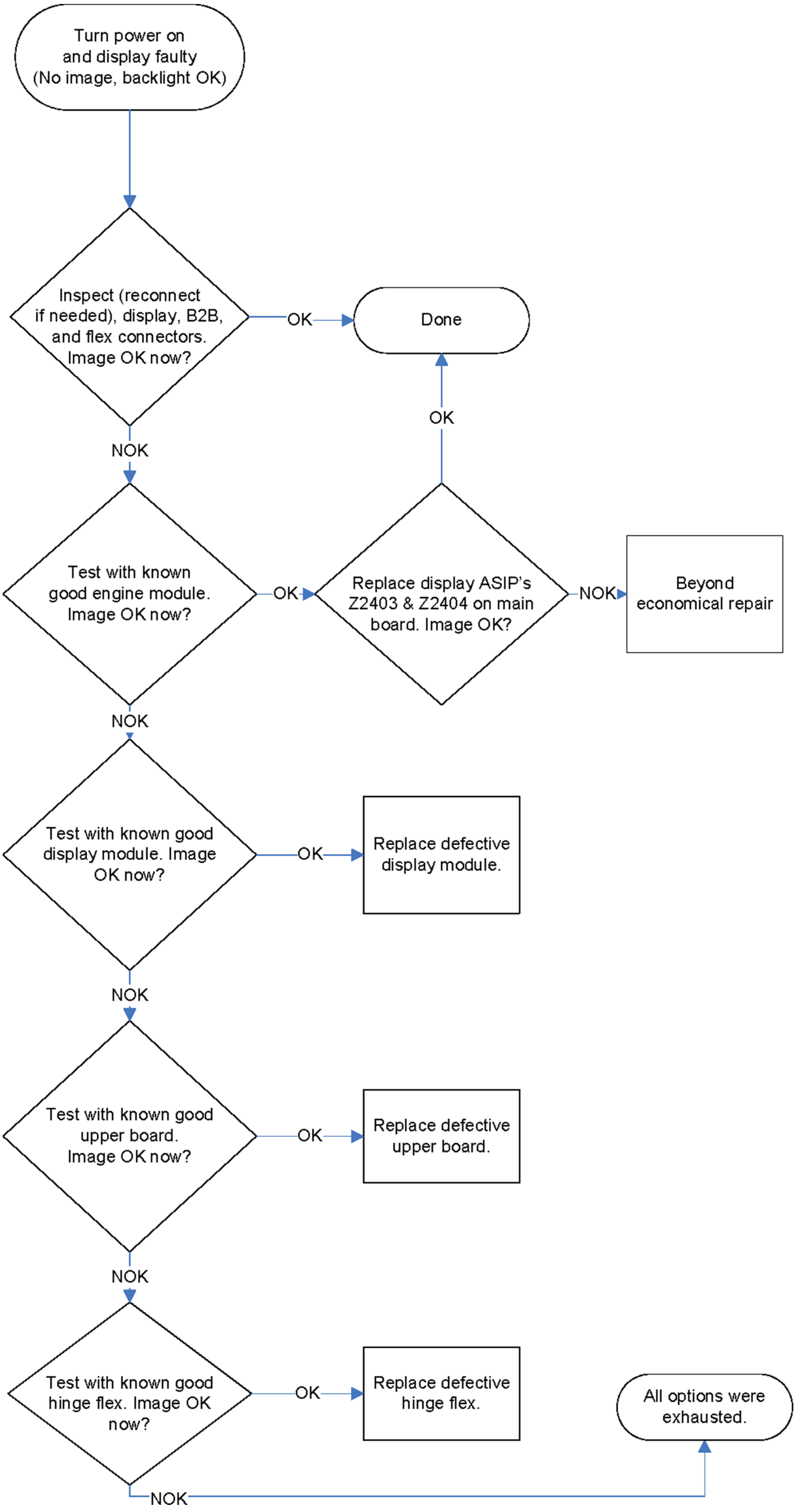
Context

There are three different display fault cases;

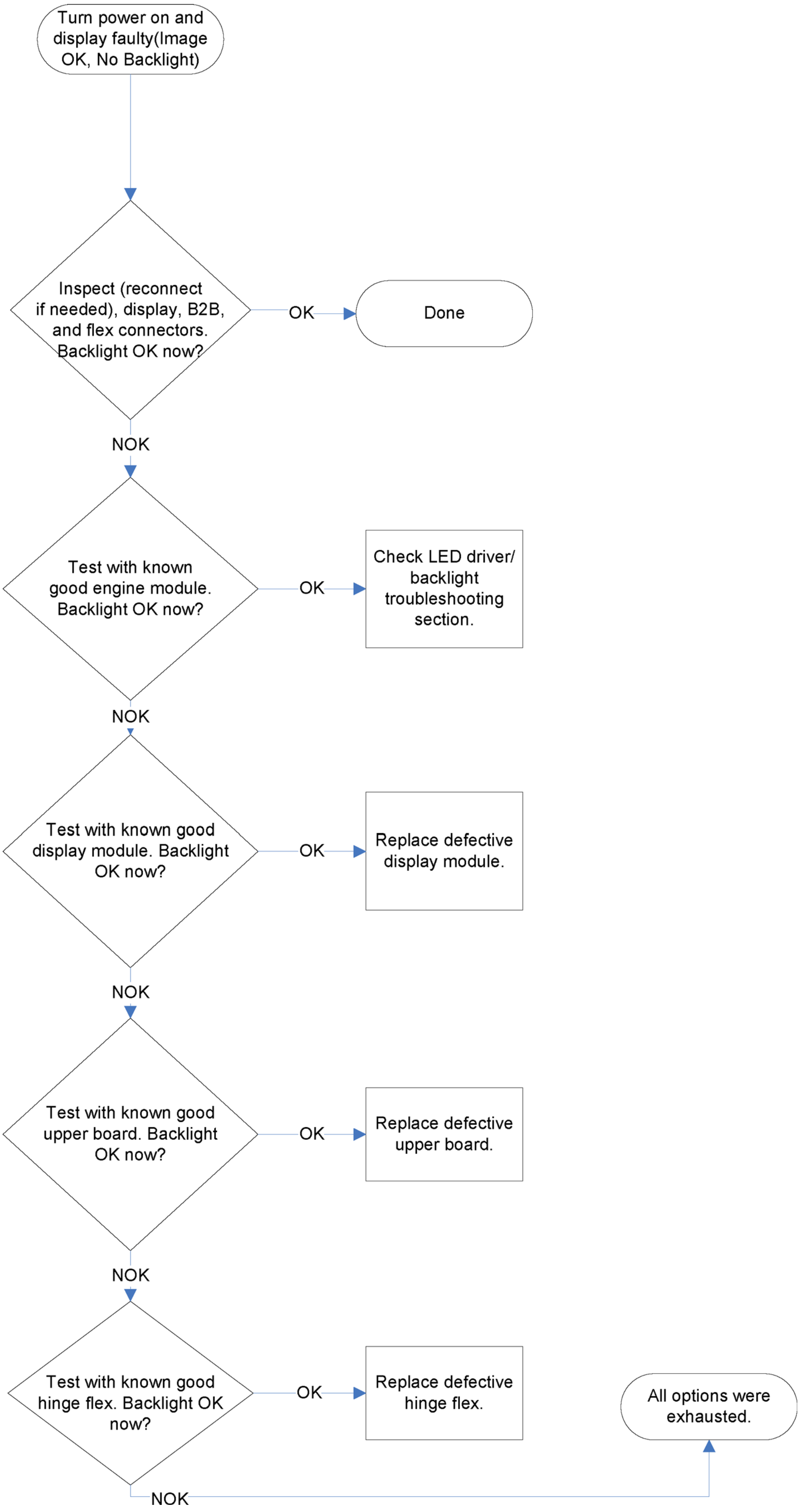
1. No backlights when image is on
2. No image when backlight is on
3. No backlight and no image

Note: When assembling/disassembling the phone, all grounding contacts between different levels (display, display flex, display frame, hinge flex connector) must be checked in order to have them properly connected.

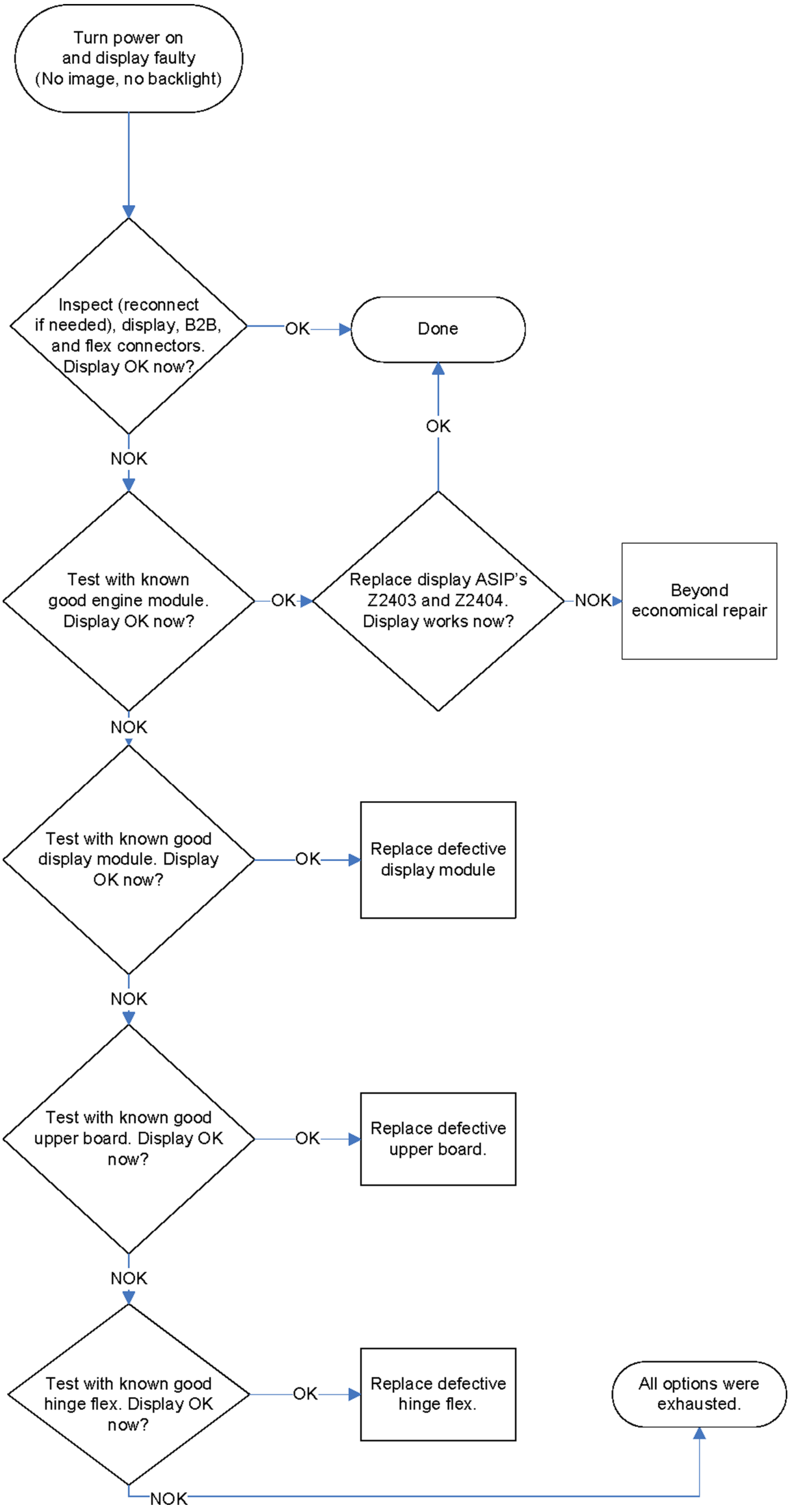
Display troubleshooting 1


Turn power on and display faulty (No image, backlight OK)
Inspect (reconnect if needed), display, B2B, and flex connectors. Image OK now?
OK
Done
NOK
OK
Test with known good engine module. Image OK now?
OK
Replace display ASIP's Z2403 & Z2404 on main board. Image OK?
NOK
Beyond economical repair
NOK
Test with known good display module. Image OK now?
OK
Replace defective display module.
NOK
Test with known good upper board. Image OK now?
OK
Replace defective upper board.
NOK
Test with known good hinge flex. Image OK now?
OK
Replace defective hinge flex.
All options were exhausted.
NOK

Display troubleshooting 2

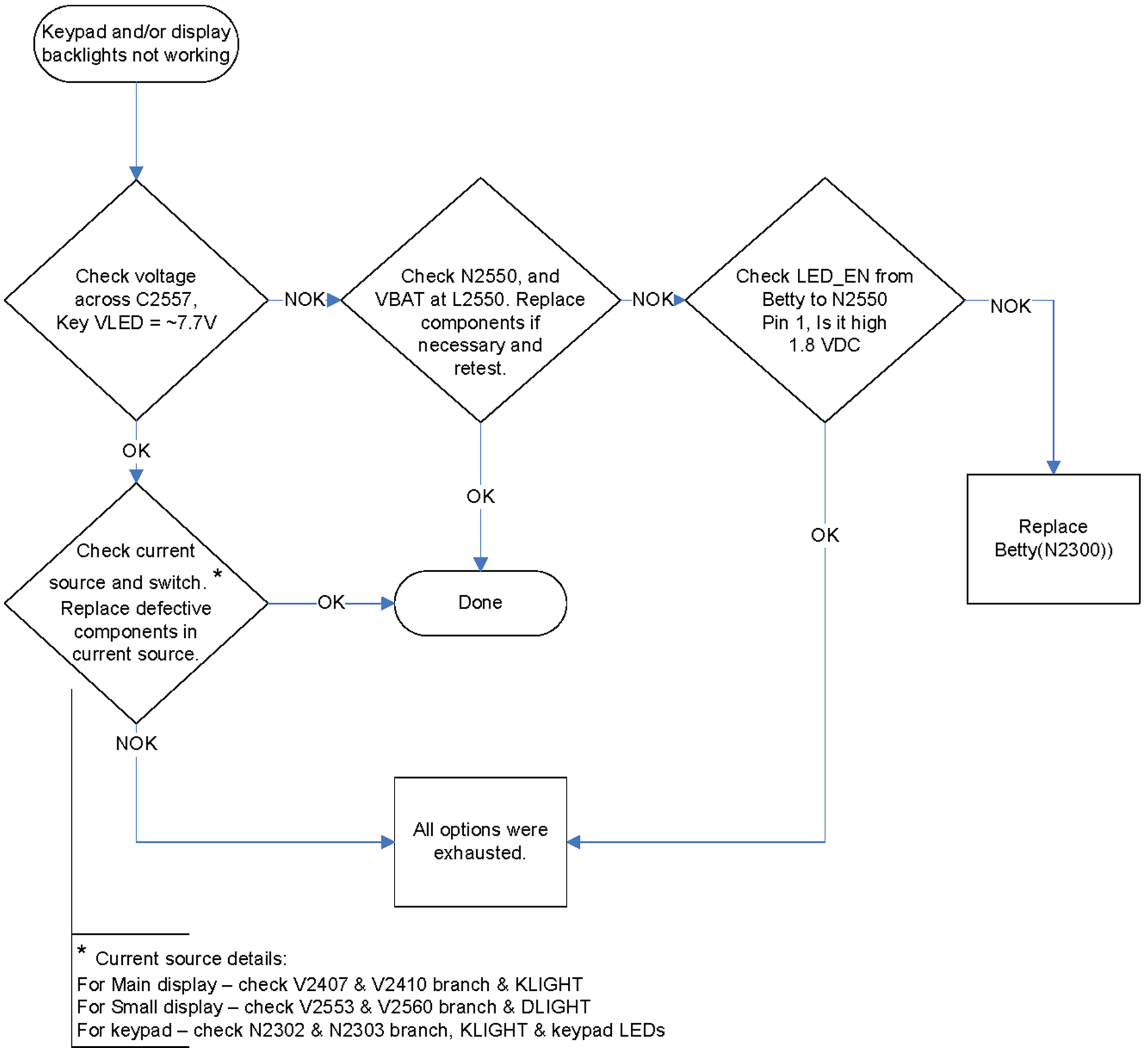

Turn power on and display faulty(Image OK, No Backlight)
Inspect (reconnect if needed), display, B2B, and flex connectors. Backlight OK now?
OK
Done
NOK
Test with known good engine module. Backlight OK now?
OK
Check LED driver/ backlight troubleshooting section.
NOK
Test with known good display module. Backlight OK now?
OK
Replace defective display module.
NOK
Test with known good upper board. Backlight OK now?
OK
Replace defective upper board.
NOK
Test with known good hinge flex. Backlight OK now?
OK
Replace defective hinge flex.
NOK
All options were exhausted.

Display troubleshooting 3


Turn power on and display faulty (No image, no backlight)
Inspect (reconnect if needed), display, B2B, and flex connectors. Display OK now?
OK
Done
OK
NOK
Test with known good engine module. Display OK now?
OK
Replace display ASIP's Z2403 and Z2404. Display works now?
NOK
Beyond economical repair
NOK
Test with known good display module. Display OK now?
OK
Replace defective display module
NOK
Test with known good upper board. Display OK now?
OK
Replace defective upper board.
NOK
Test with known good hinge flex. Display OK now?
OK
Replace defective hinge flex.
All options were exhausted.
NOK

LED driver troubleshooting

Troubleshooting flow


Keypad and/or display backlights not working
Check voltage across C2557, Key VLED = ~7.7V
NOK
Check N2550, and VBAT at L2550. Replace components if necessary and retest.
NOK
Check LED_EN from Betty to N2550 Pin 1, Is it high 1.8 VDC
NOK
Replace Betty(N2300))
OK
OK
OK
Check current source and switch. * Replace defective components in current source.
OK
Done
NOK
All options were exhausted.
* Current source details:
For Main display – check V2407 & V2410 branch & KLIGHT
For Small display – check V2553 & V2560 branch & DLIGHT
For keypad – check N2302 & N2303 branch, KLIGHT & keypad LEDs

Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Taking and evaluating test pictures with main camera

When *taking* a test picture, remember the following:

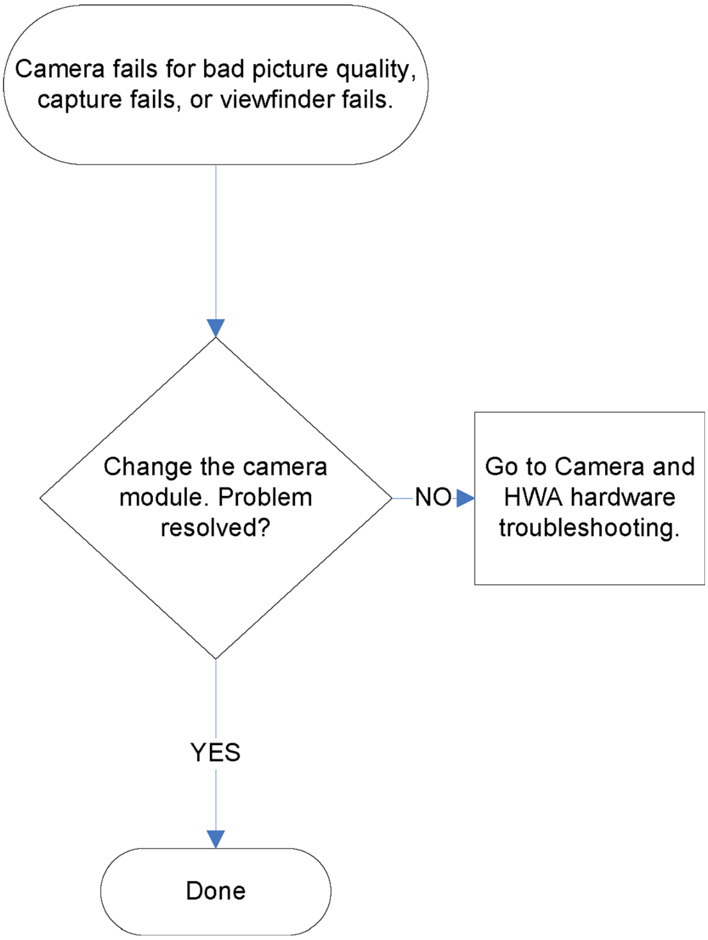
- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when taking the picture
- Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- If phone has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device

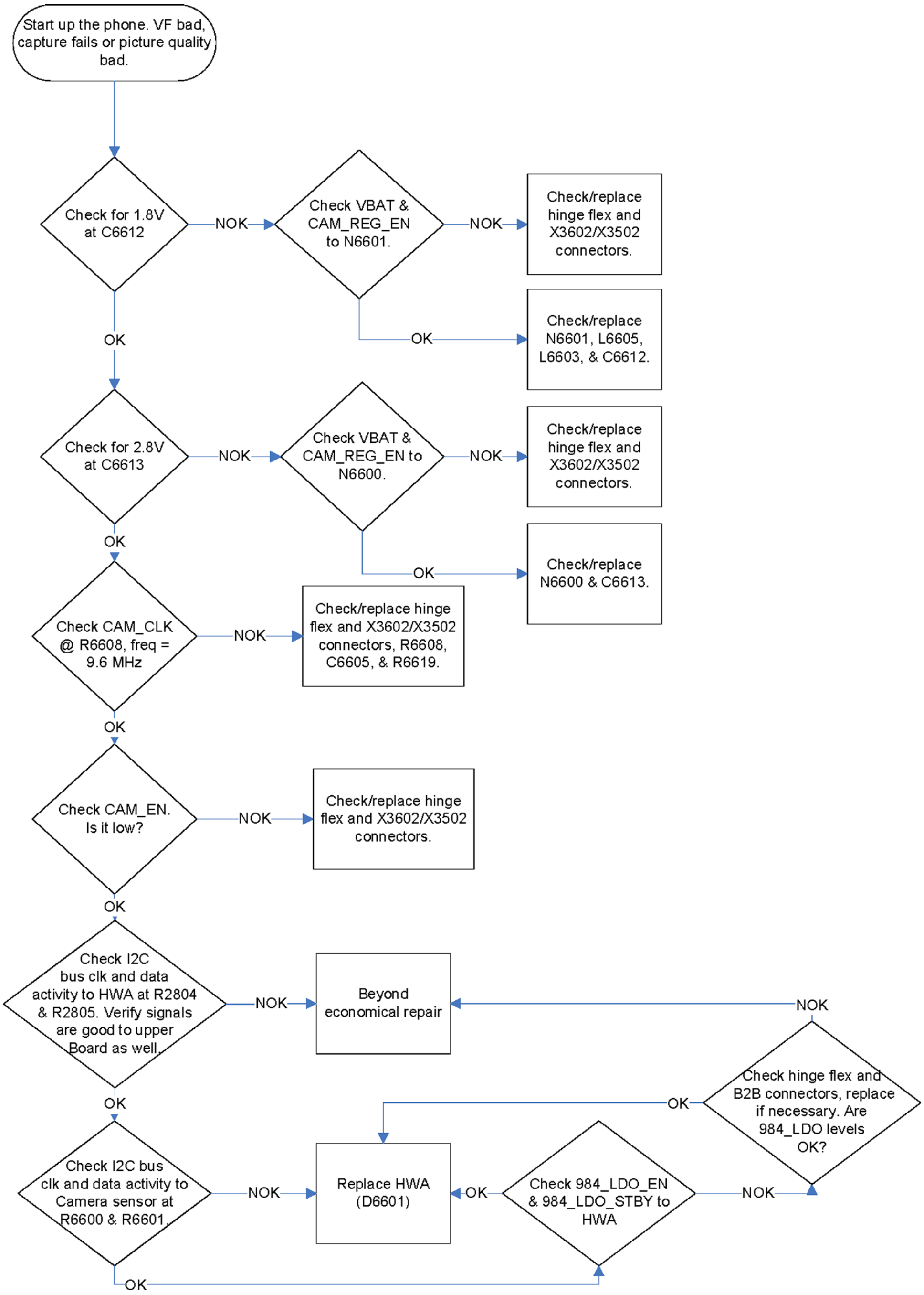
Camera troubleshooting

Troubleshooting flow


Camera fails for bad picture quality, capture fails, or viewfinder fails.
Change the camera module. Problem resolved?
NO
Go to Camera and HWA hardware troubleshooting.
YES
Done

Camera and HWA hardware troubleshooting

Troubleshooting flow


Start up the phone. VF bad, capture fails or picture quality bad.
Check for 1.8V at C6612
NOK
Check VBAT & CAM_REG_EN to N6601.
NOK
Check/replace hinge flex and X3602/X3502 connectors.
OK
Check/replace N6601, L6605, L6603, & C6612.
OK
Check for 2.8V at C6613
NOK
Check VBAT & CAM_REG_EN to N6600.
NOK
Check/replace hinge flex and X3602/X3502 connectors.
OK
Check/replace N6600 & C6613.
OK
Check CAM_CLK @ R6608, freq = 9.6 MHz
NOK
Check/replace hinge flex and X3602/X3502 connectors, R6608, C6605, & R6619.
OK
Check CAM_EN. Is it low?
NOK
Check/replace hinge flex and X3602/X3502 connectors.
OK
Check I2C bus clk and data activity to HWA at R2804 & R2805. Verify signals are good to upper Board as well.
NOK
Beyond economical repair
NOK
Check hinge flex and B2B connectors, replace if necessary. Are 984_LDO levels OK?
OK
OK
Check I2C bus clk and data activity to Camera sensor at R6600 & R6601.
NOK
Replace HWA (D6601)
OK
Check 984_LDO_EN & 984_LDO_STBY to HWA
NOK
OK

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

The input signal for each loop test is single-ended.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- External microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

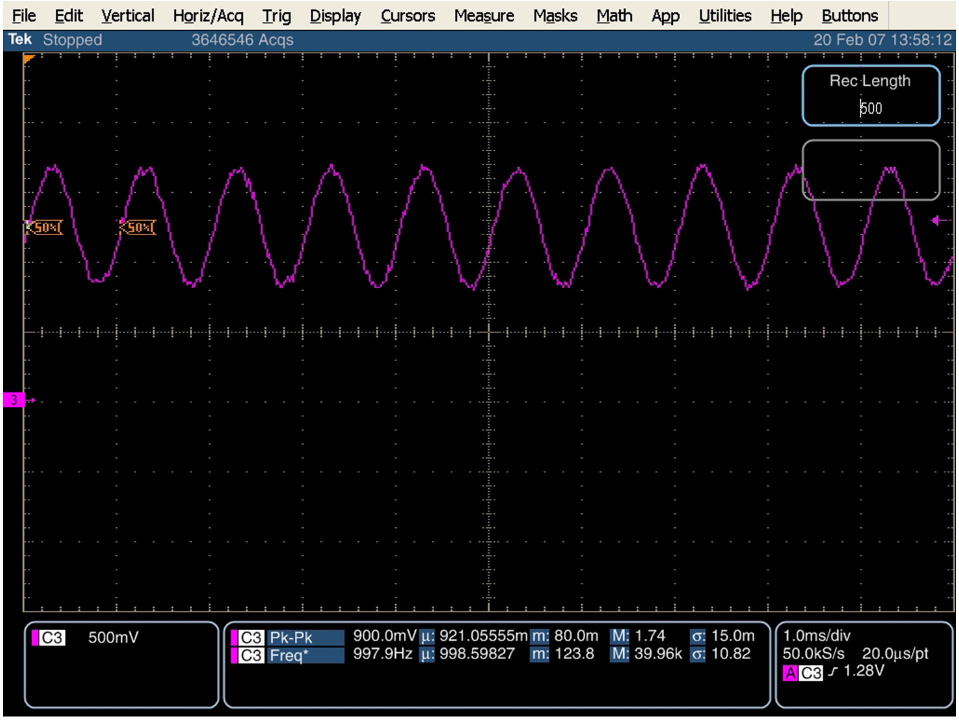
Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

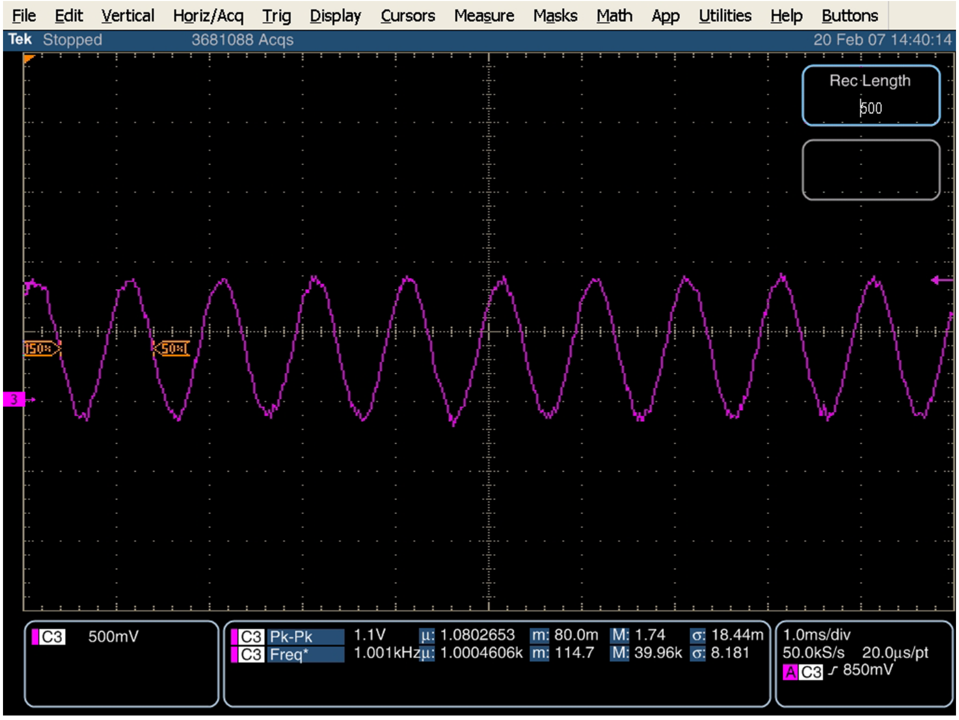
Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HS_Ear_L and GND	0.8	1000	1100mV	0.5	N/A
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-0.5	1000	940mV	1.2	N/A
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2101 pads	N/A	1000	Square with amplitude equal to VBAT	1.9	N/A

Measurement data


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Masks Math App Utilities Help Buttons
Rec Length
500
50%
50%
3

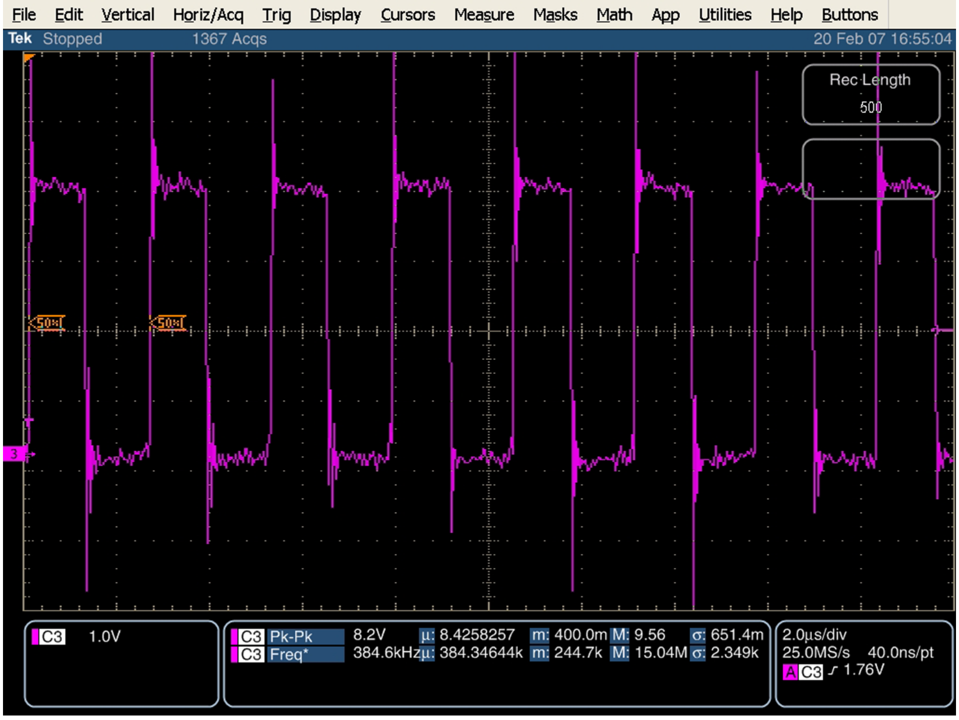
```
Tek Stopped    3646546 Acqs                                   20 Feb 07 13:58:12
C3  500mV
C3 Pk-Pk  900.0mV µ: 921.05555m m: 80.0m M: 1.74   σ: 15.0m
C3 Freq*  997.9Hz µ: 998.59827  m: 123.8 M: 39.96k σ: 10.82
1.0ms/div
50.0kS/s   20.0µs/pt
A C3 ƒ 1.28V
```

Figure 5 External input Ear out


File Edit Vertical Horiz/Acq Trig Display Cursors Measure Masks Math App Utilities Help Buttons
Rec Length
500
50%
50%
3

```
Tek Stopped    3681088 Acqs                                   20 Feb 07 14:40:14
C3  500mV
C3 Pk-Pk  1.1V      µ: 1.0802653  m: 80.0m M: 1.74   σ: 18.44m
C3 Freq*  1.001kHz µ: 1.0004606k m: 114.7 M: 39.96k σ: 8.181
1.0ms/div
50.0kS/s   20.0µs/pt
A C3 ƒ 850mV
```

Figure 6 External input HS_EAR_L out

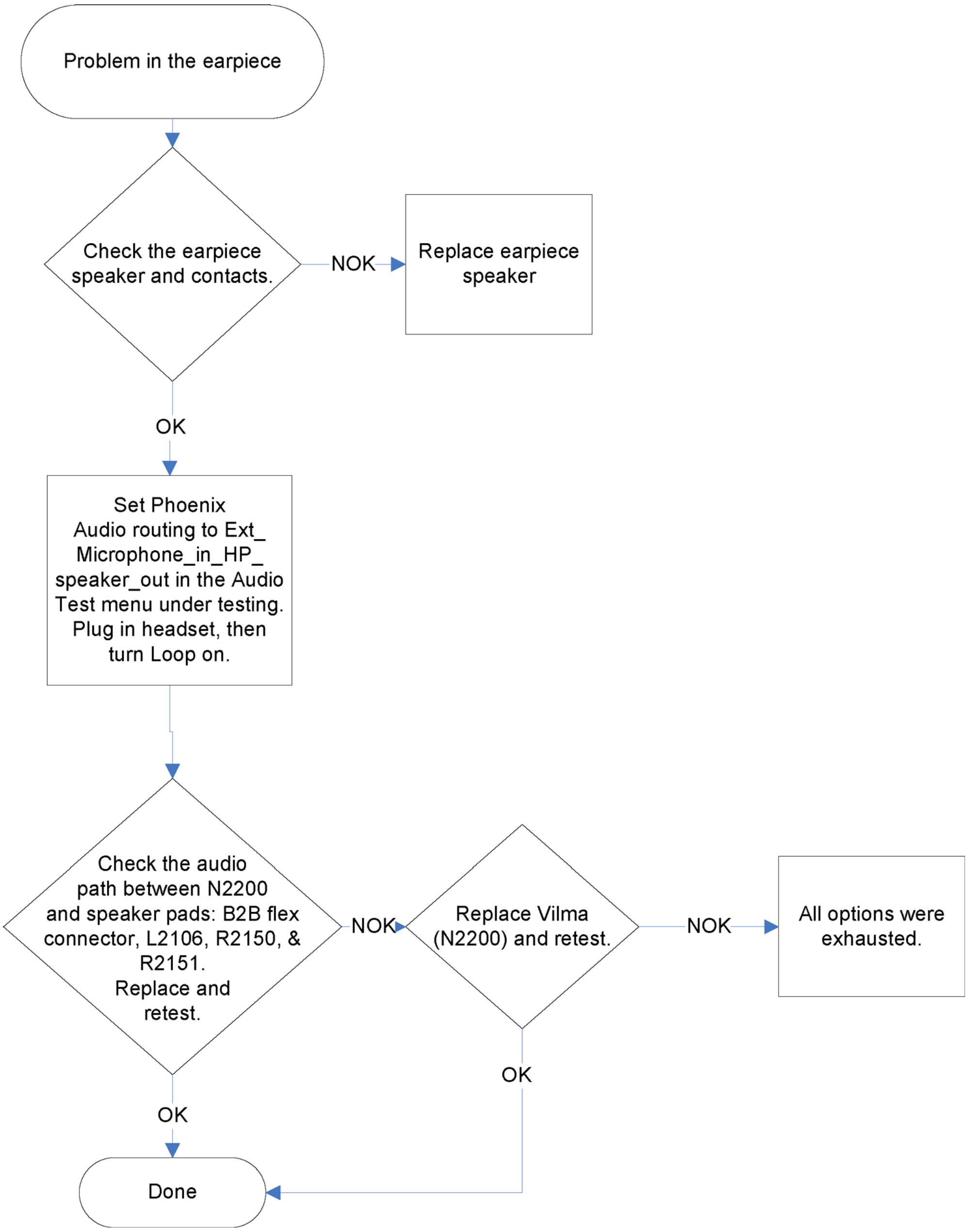

File
Edit
Vertical
Horiz/Acq
Trig
Display
Cursors
Measure
Masks
Math
App
Utilities
Help
Buttons
Tek Stopped
1367 Acqs
20 Feb 07 16:55:04
Rec Length
500
50%
50%
3

```
C3    1.0V

C3 Pk-Pk   8.2V      µ: 8.4258257  m: 400.0m M: 9.56    σ: 651.4m
C3 Freq*   384.6kHz  µ: 384.34644k m: 244.7k M: 15.04M  σ: 2.349k

2.0µs/div
25.0MS/s   40.0ns/pt
A C3 ⨍ 1.76V
```

Figure 7 External input IHF out

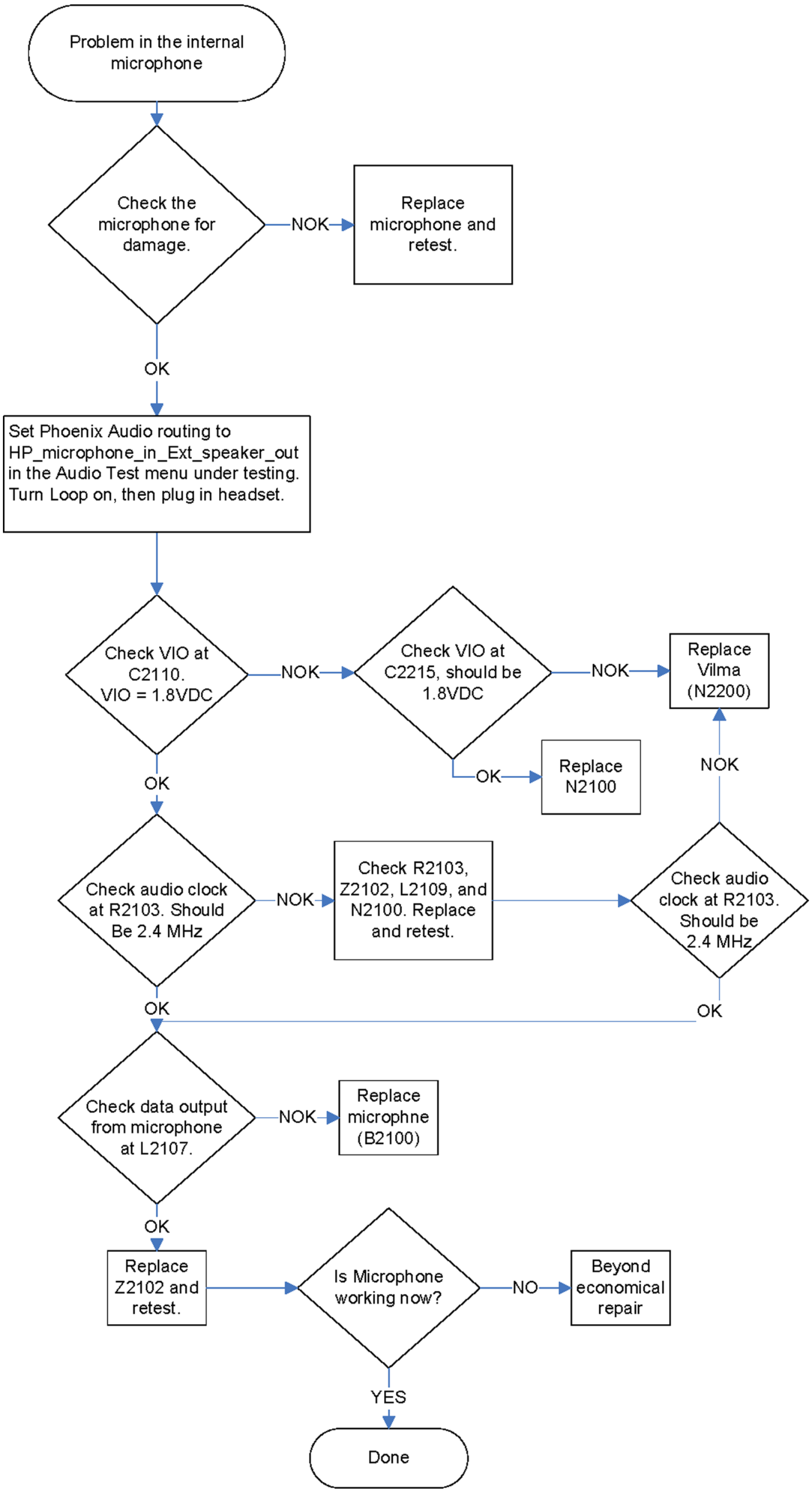
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Check the earpiece speaker and contacts.
NOK
Replace earpiece speaker
OK
Set Phoenix Audio routing to Ext_ Microphone_in_HP_ speaker_out in the Audio Test menu under testing. Plug in headset, then turn Loop on.
Check the audio path between N2200 and speaker pads: B2B flex connector, L2106, R2150, & R2151. Replace and retest.
NOK
Replace Vilma (N2200) and retest.
NOK
All options were exhausted.
OK
OK
Done

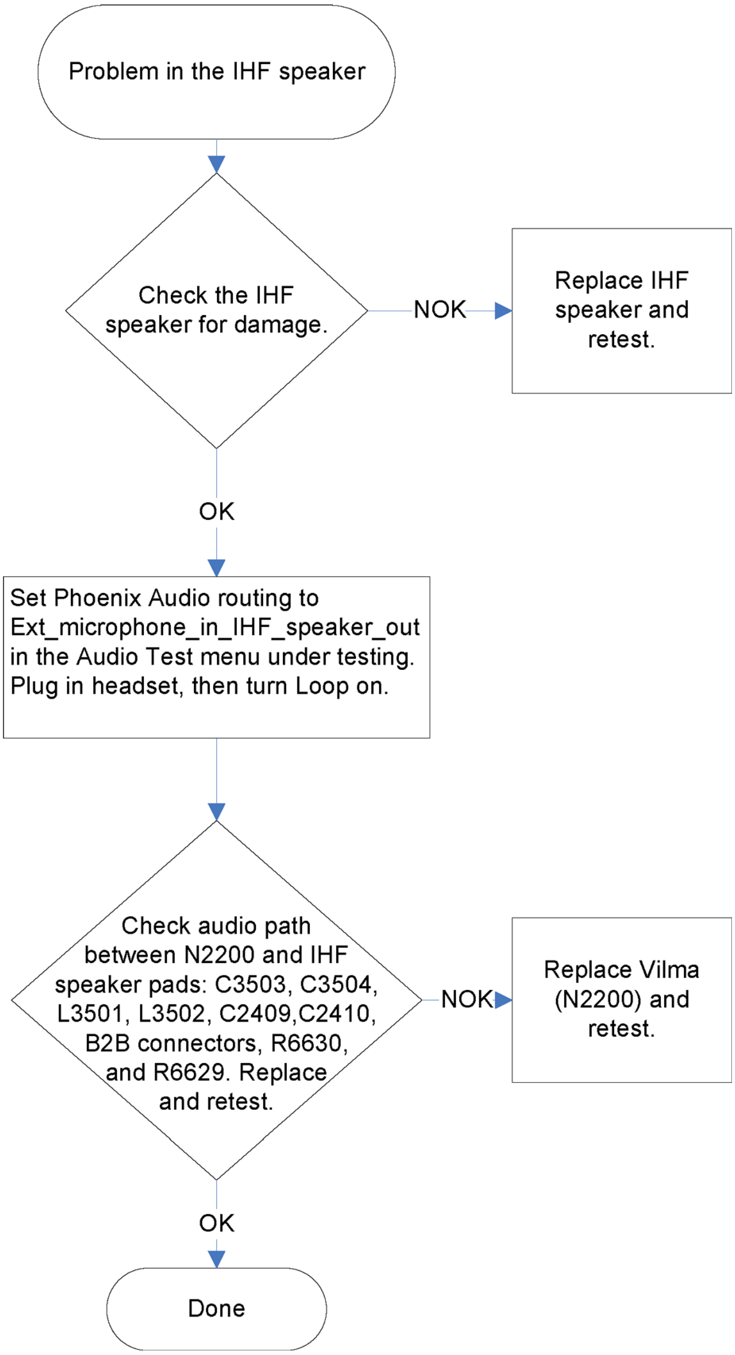
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone
Check the microphone for damage.
NOK
Replace microphone and retest.
OK
Set Phoenix Audio routing to HP_microphone_in_Ext_speaker_out in the Audio Test menu under testing. Turn Loop on, then plug in headset.
Check VIO at C2110. VIO = 1.8VDC
NOK
Check VIO at C2215, should be 1.8VDC
NOK
Replace Vilma (N2200)
OK
Replace N2100
NOK
OK
Check audio clock at R2103. Should Be 2.4 MHz
NOK
Check R2103, Z2102, L2109, and N2100. Replace and retest.
Check audio clock at R2103. Should be 2.4 MHz
OK
OK
Check data output from microphone at L2107.
NOK
Replace microphne (B2100)
OK
Replace Z2102 and retest.
Is Microphone working now?
NO
Beyond economical repair
YES
Done

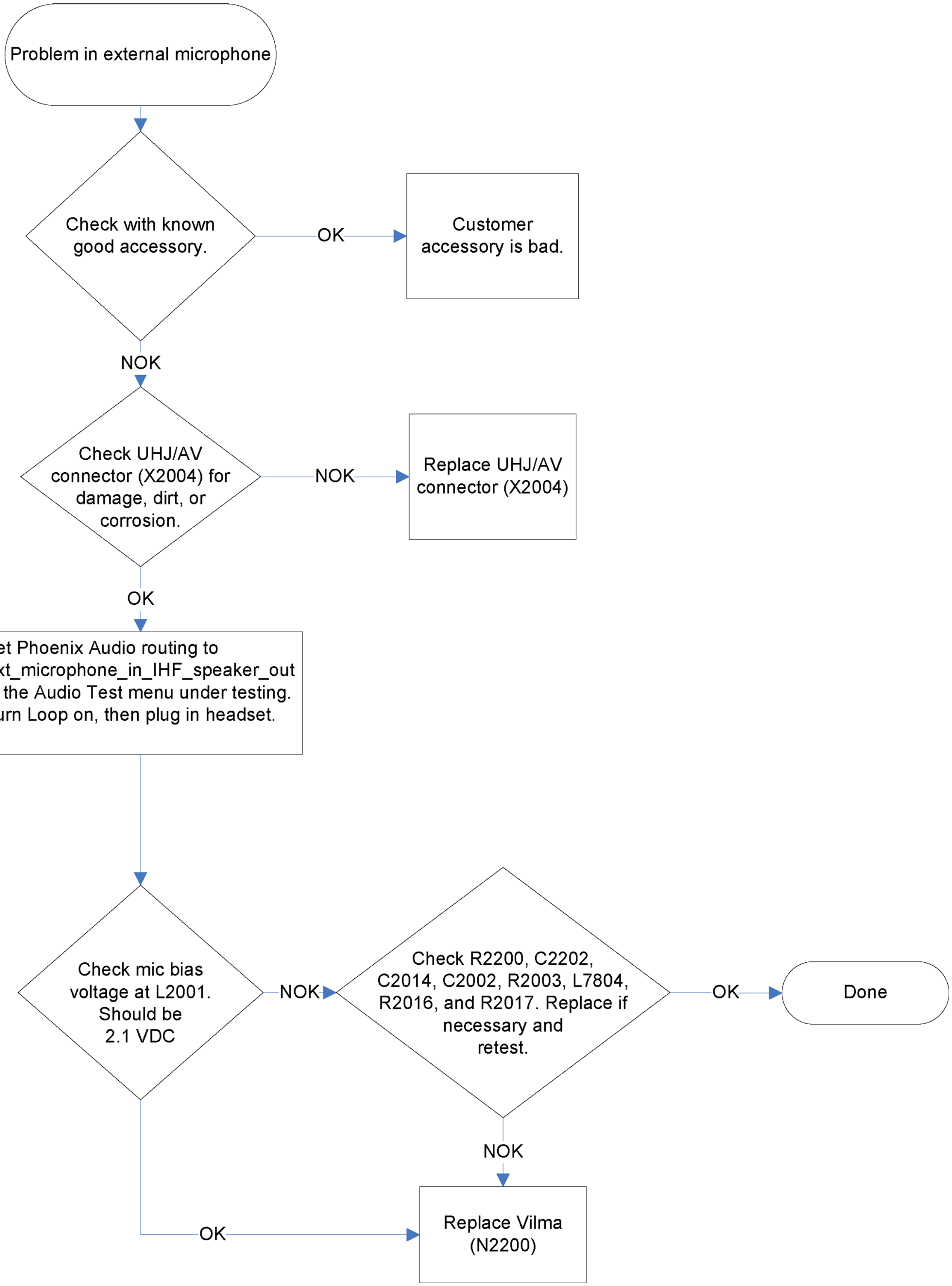
Internal handsfree (IHF) troubleshooting

Troubleshooting flow


Problem in the IHF speaker
Check the IHF speaker for damage.
NOK
Replace IHF speaker and retest.
OK
Set Phoenix Audio routing to Ext_microphone_in_IHF_speaker_out in the Audio Test menu under testing. Plug in headset, then turn Loop on.
Check audio path between N2200 and IHF speaker pads: C3503, C3504, L3501, L3502, C2409,C2410, B2B connectors, R6630, and R6629. Replace and retest.
NOK
Replace Vilma (N2200) and retest.
OK
Done

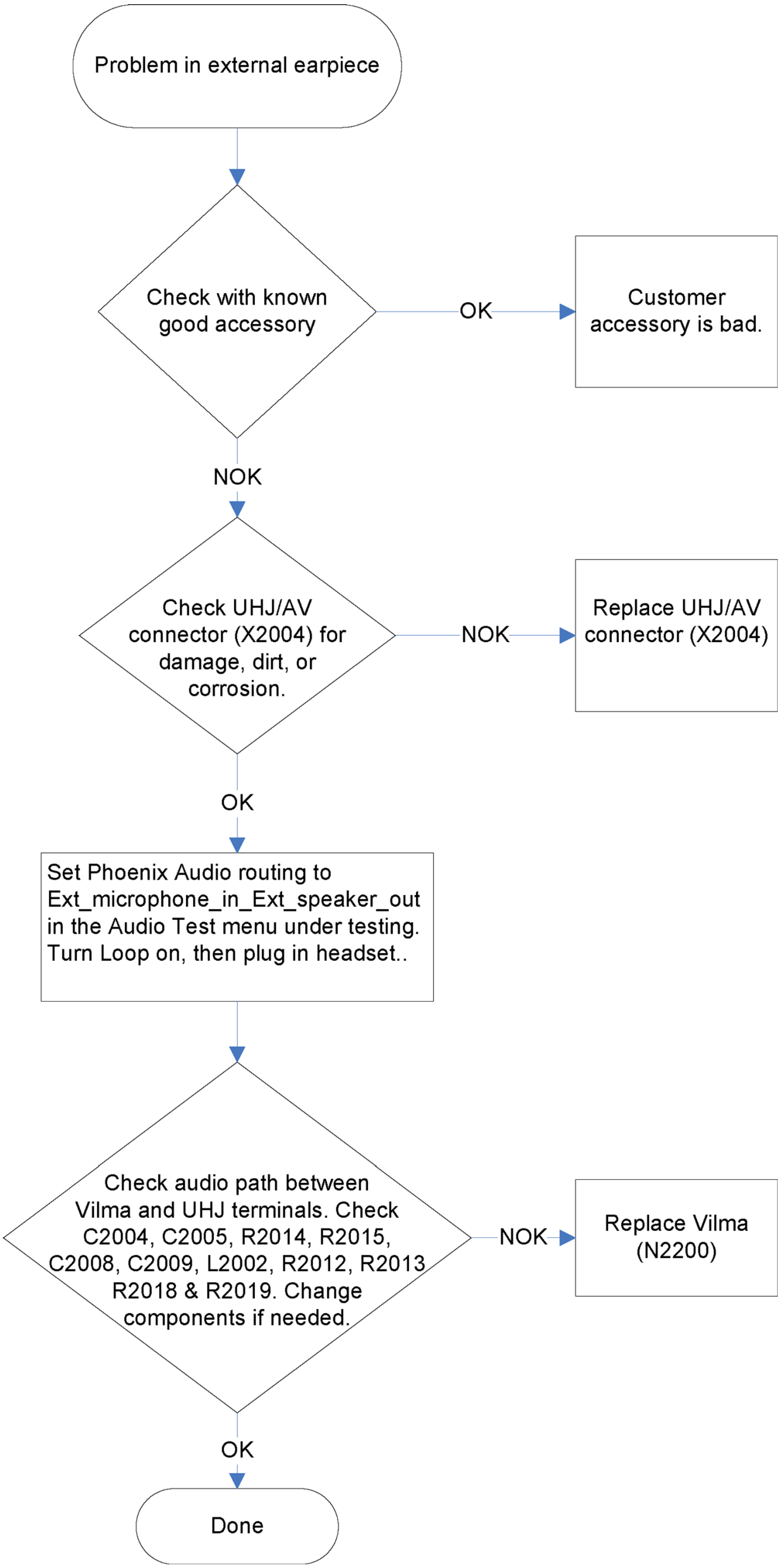
External microphone troubleshooting

Troubleshooting flow


Problem in external microphone
Check with known good accessory.
OK
Customer accessory is bad.
NOK
Check UHJ/AV connector (X2004) for damage, dirt, or corrosion.
NOK
Replace UHJ/AV connector (X2004)
OK
Set Phoenix Audio routing to Ext_microphone_in_IHF_speaker_out in the Audio Test menu under testing. Turn Loop on, then plug in headset.
Check mic bias voltage at L2001. Should be 2.1 VDC
NOK
Check R2200, C2202, C2014, C2002, R2003, L7804, R2016, and R2017. Replace if necessary and retest.
OK
Done
NOK
OK
Replace Vilma (N2200)

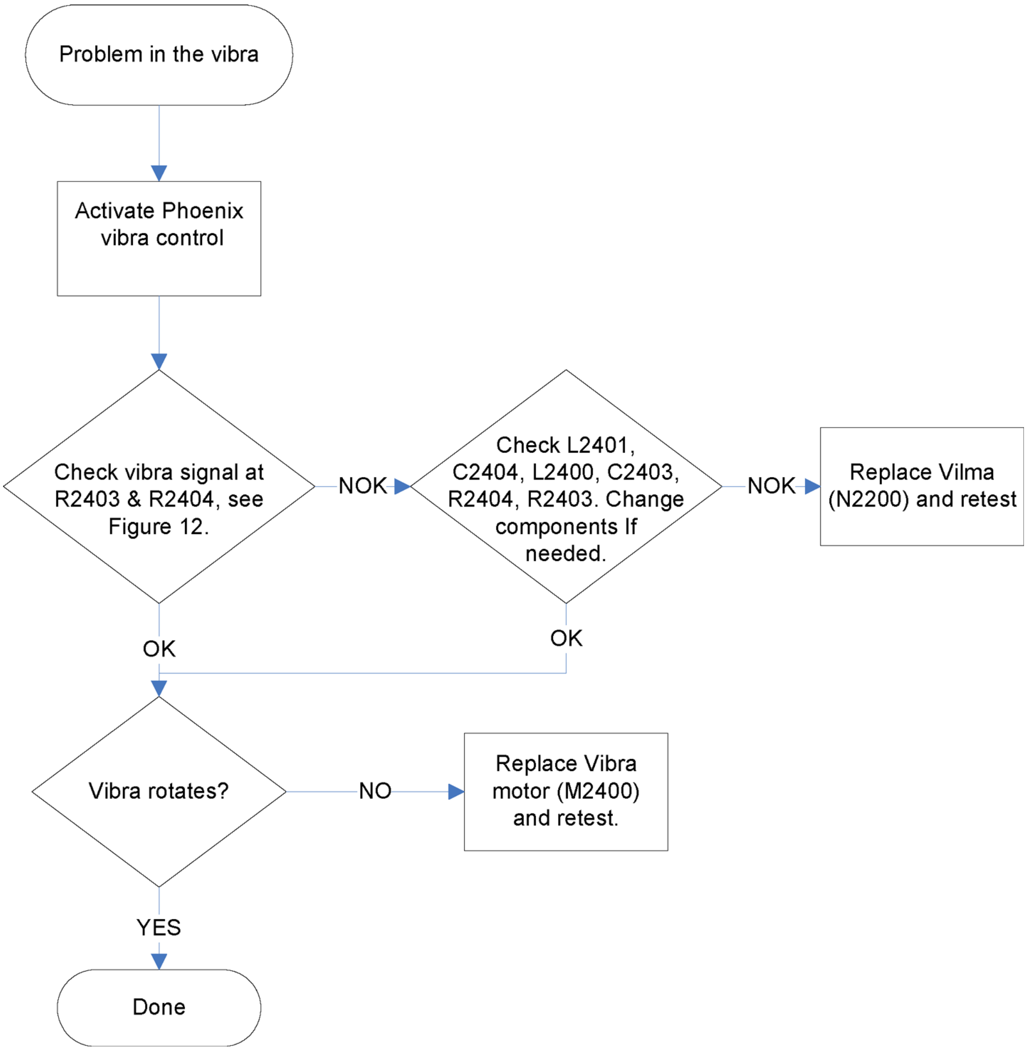
External earpiece troubleshooting

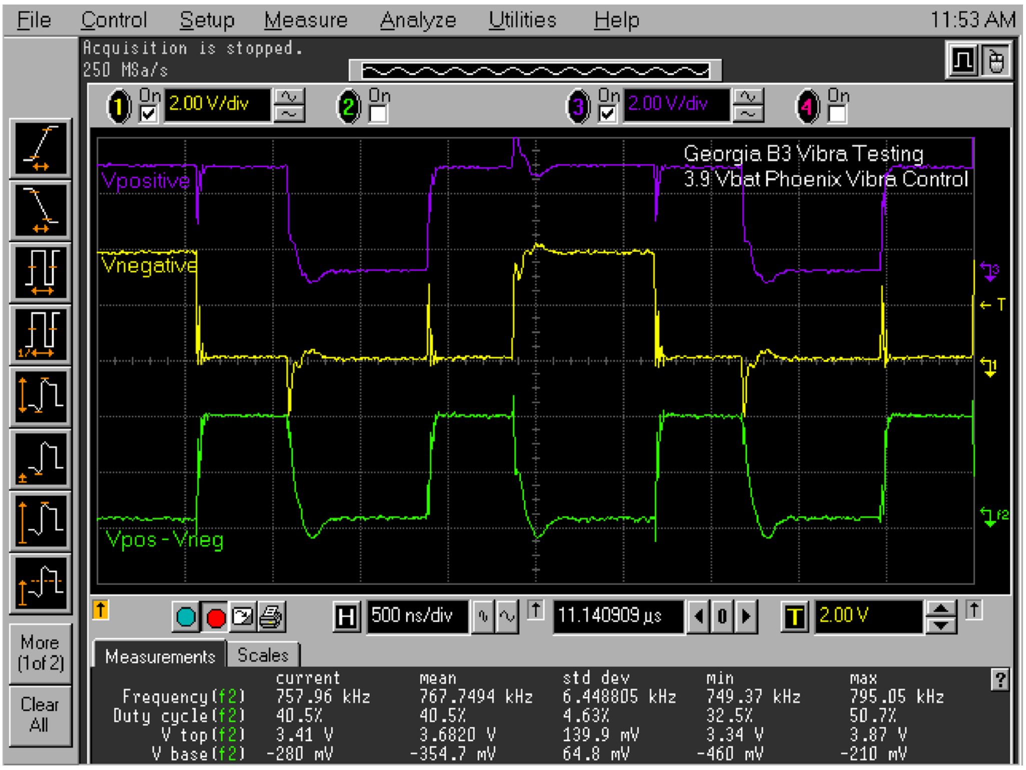
Troubleshooting flow


Problem in external earpiece
Check with known good accessory
OK
Customer accessory is bad.
NOK
Check UHJ/AV connector (X2004) for damage, dirt, or corrosion.
NOK
Replace UHJ/AV connector (X2004)
OK
Set Phoenix Audio routing to Ext_microphone_in_Ext_speaker_out in the Audio Test menu under testing. Turn Loop on, then plug in headset..
Check audio path between Vilma and UHJ terminals. Check C2004, C2005, R2014, R2015, C2008, C2009, L2002, R2012, R2013 R2018 & R2019. Change components if needed.
NOK
Replace Vilma (N2200)
OK
Done

Vibra troubleshooting

Troubleshooting flow


Problem in the vibra
Activate Phoenix vibra control
Check vibra signal at R2403 & R2404, see Figure 12.
NOK
Check L2401, C2404, L2400, C2403, R2404, R2403. Change components If needed.
NOK
Replace Vilma (N2200) and retest
OK
OK
Vibra rotates?
NO
Replace Vibra motor (M2400) and retest.
YES
Done


File
Control
Setup
Measure
Analyze
Utilities
Help
11:53 AM
1 On 2.00 V/div
2 On
3 On 2.00 V/div
4 On
Georgia B3 Vibra Testing
3.9 Vbat Phoenix Vibra Control
Vpositive
Vnegative
Vpos - Vneg
More (1 of 2)
Clear All
H 500 ns/div
11.140909 µs
T 2.00 V
Measurements
Scales

```
Acquisition is stopped.
250 MSa/s
```

```
                 current       mean           std dev         min          max
  Frequency(f2)  757.96 kHz    767.7494 kHz   6.448805 kHz    749.37 kHz   795.05 kHz
 Duty cycle(f2)  40.5%         40.5%          4.63%           32.5%        50.7%
      V top(f2)  3.41 V        3.6820 V       139.9 mV        3.34 V       3.87 V
     V base(f2) -280 mV       -354.7 mV       64.8 mV        -460 mV      -210 mV
```

Figure 8 Vibra signals

Bluetooth troubleshooting

Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

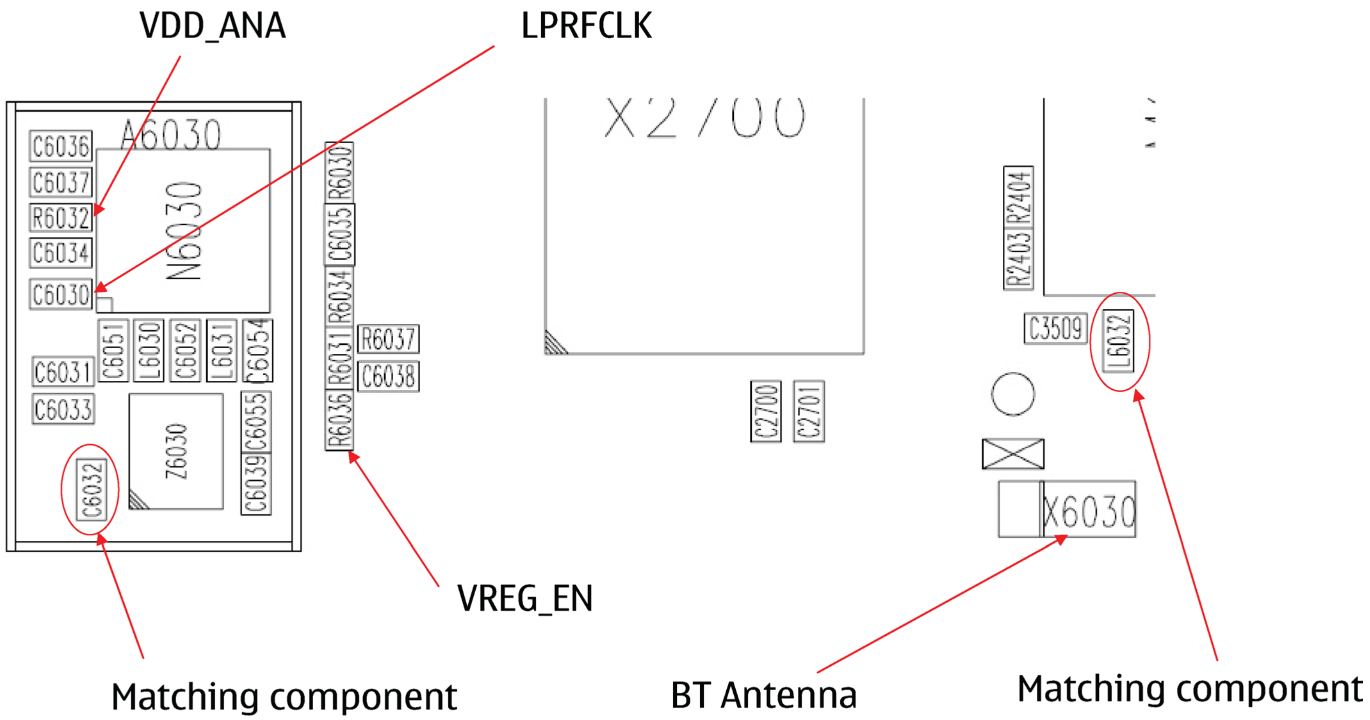

VDD_ANA
LPRFCLK
A6030
N6030
C6036
C6037
R6032
C6034
C6030
C6031
C6033
C6051
L6030
C6052
L6031
C6054
Z6030
C6032
C6039
C6055
R6030
C6035
R6034
R6031
R6036
R6037
C6038
X2700
C2700
C2701
R2403
R2404
C3509
L6032
X6030
VREG_EN
Matching component
BT Antenna
Matching component

Figure 9 Bluetooth component layout

Bluetooth settings for Phoenix

Steps

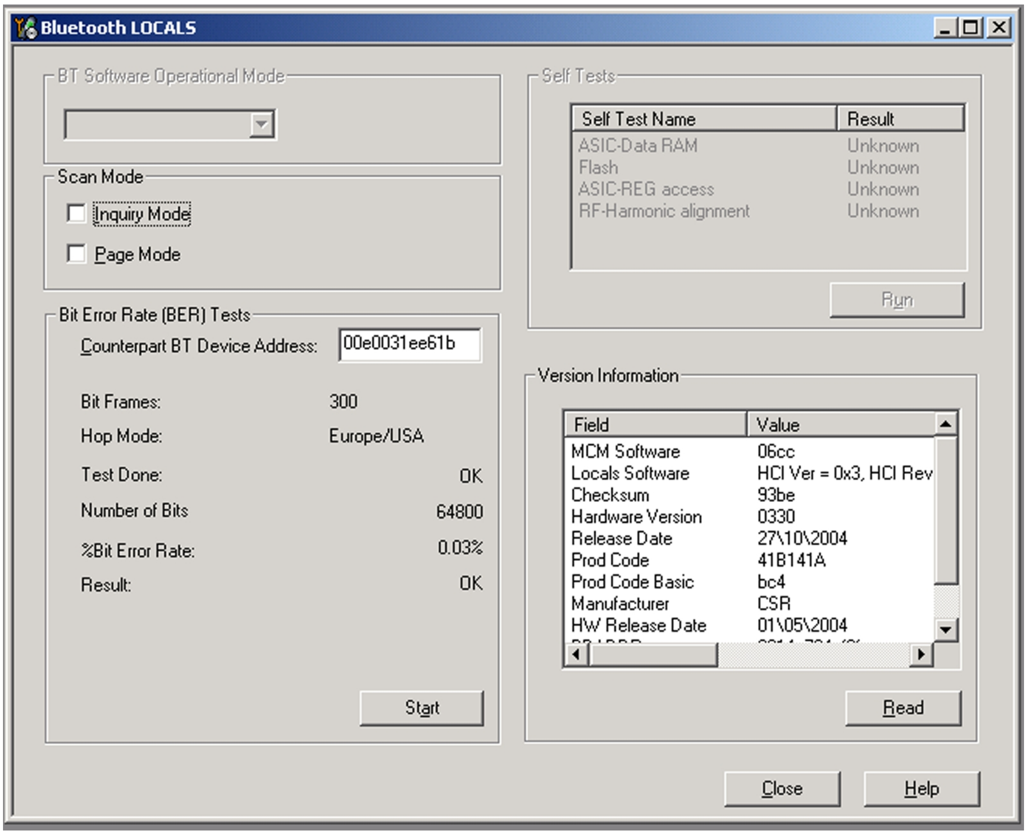
1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.

   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Bluetooth LOCALS
BT Software Operational Mode
Scan Mode
☐ Inquiry Mode
☐ Page Mode
Bit Error Rate (BER) Tests
Start
Self Tests
Run
Version Information
Read
Close
Help

Counterpart BT Device Address: 00e0031ee61b

Bit Frames: 300

Hop Mode: Europe/USA

Test Done: OK

Number of Bits: 64800

%Bit Error Rate: 0.03%

Result: OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

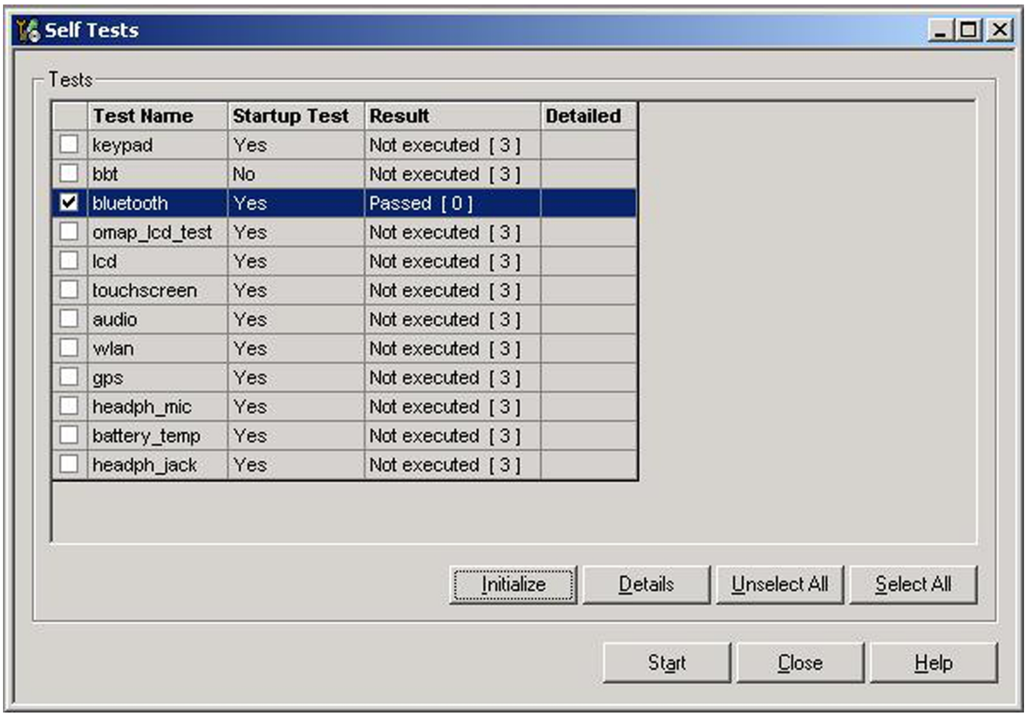
Figure 10 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
    - **ST_LPRF_IF_TEST**
    - **ST_LPRF_AUDIO_LINES_TEST**
    - **ST_BT_WAKEUP_TEST**
    - **ST_BT_SLPCLK_TEST**
7. Open **Testing Bluetooth Locals**.
8. Click **Update Data**.
9. Click **Run Self Test**.

10. To run the tests, click **Start**.

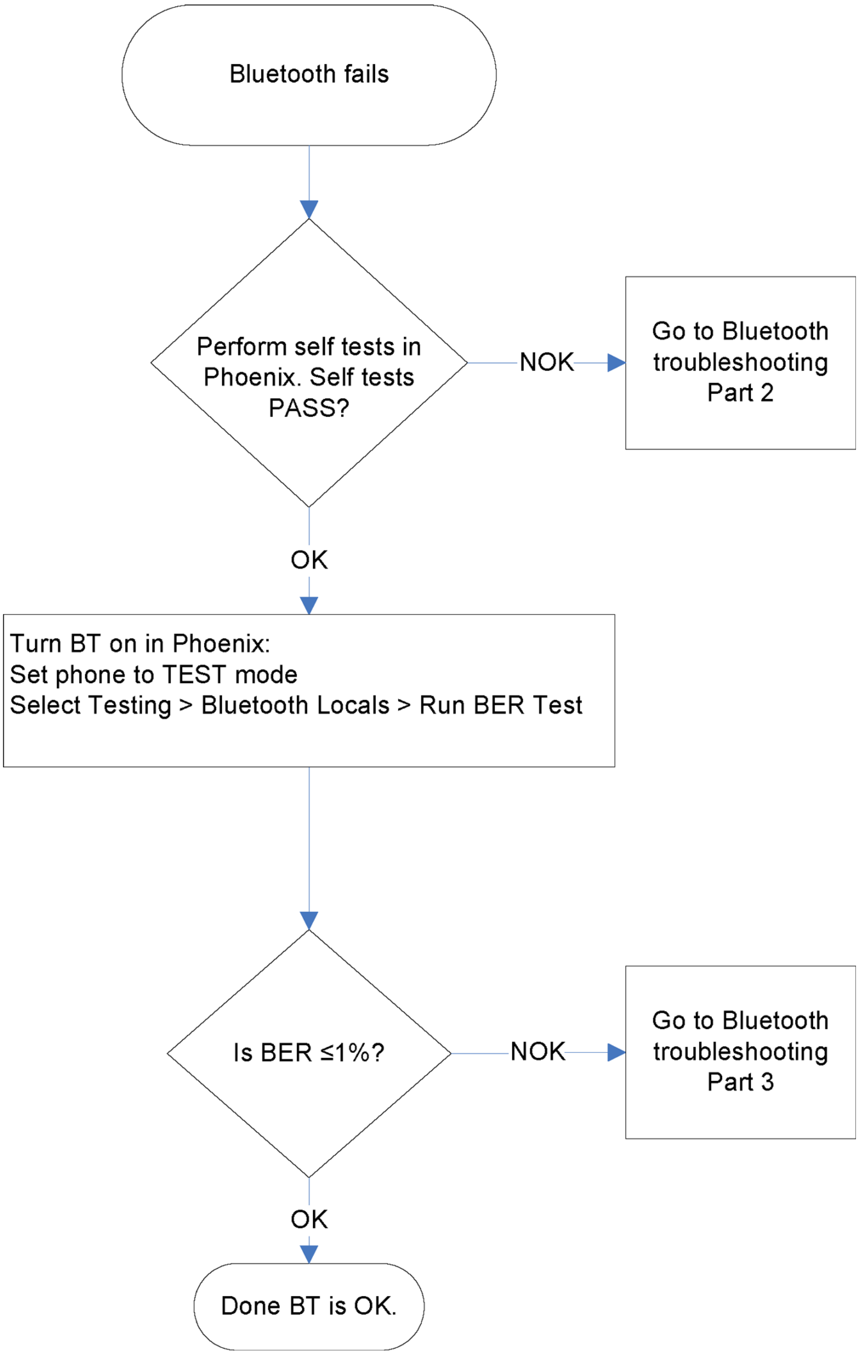

Self Tests
Tests
Initialize
Details
Unselect All
Select All
Start
Close
Help

	Test Name	Startup Test	Result	Detailed
☐	keypad	Yes	Not executed [3]	
☐	bbt	No	Not executed [3]	
☑	bluetooth	Yes	Passed [0]	
☐	omap_lcd_test	Yes	Not executed [3]	
☐	lcd	Yes	Not executed [3]	
☐	touchscreen	Yes	Not executed [3]	
☐	audio	Yes	Not executed [3]	
☐	wlan	Yes	Not executed [3]	
☐	gps	Yes	Not executed [3]	
☐	headph_mic	Yes	Not executed [3]	
☐	battery_temp	Yes	Not executed [3]	
☐	headph_jack	Yes	Not executed [3]	

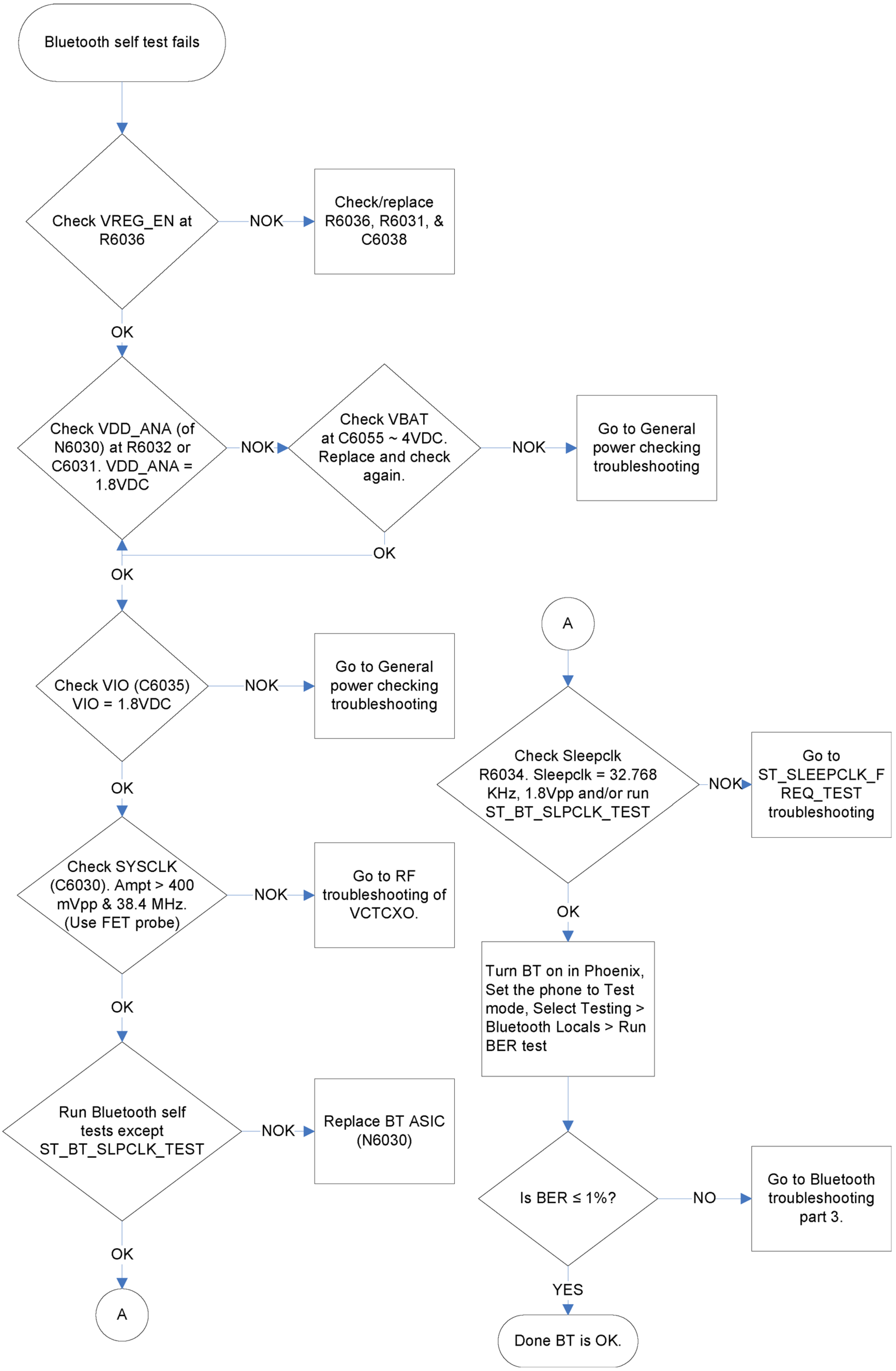
Figure 11 Bluetooth self tests in *Phoenix*

Bluetooth troubleshooting

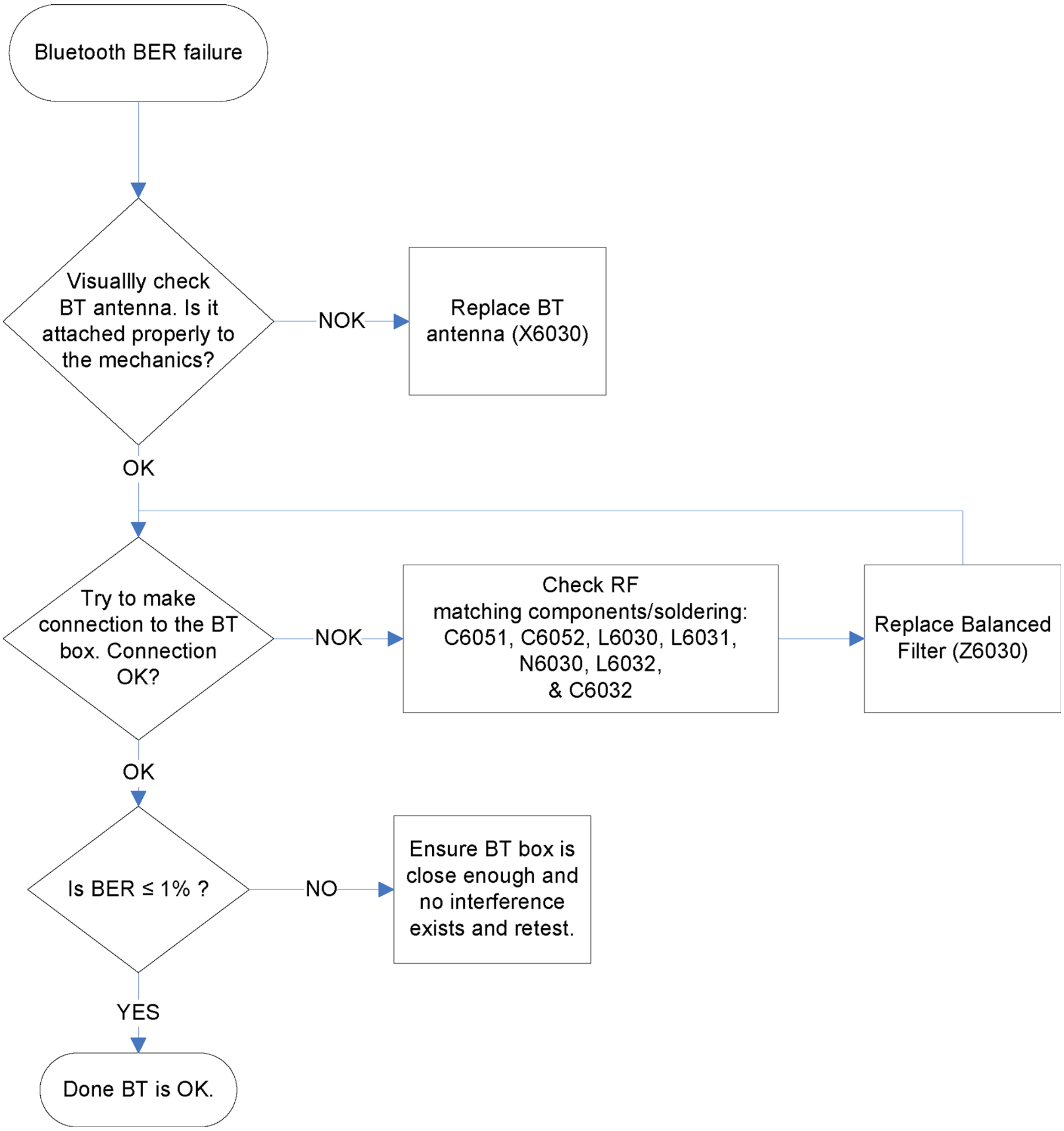
Part 1: Bluetooth troubleshooting


Bluetooth fails
Perform self tests in Phoenix. Self tests PASS?
NOK
Go to Bluetooth troubleshooting Part 2
OK
Turn BT on in Phoenix:
Set phone to TEST mode
Select Testing > Bluetooth Locals > Run BER Test
Is BER ≤1%?
NOK
Go to Bluetooth troubleshooting Part 3
OK
Done BT is OK.

Part 2: Bluetooth self test failed


Bluetooth self test fails
Check VREG_EN at R6036
NOK
Check/replace R6036, R6031, & C6038
OK
Check VDD_ANA (of N6030) at R6032 or C6031. VDD_ANA = 1.8VDC
NOK
Check VBAT at C6055 ~ 4VDC. Replace and check again.
NOK
Go to General power checking troubleshooting
OK
OK
Check VIO (C6035) VIO = 1.8VDC
NOK
Go to General power checking troubleshooting
OK
Check SYSCLK (C6030). Ampt > 400 mVpp & 38.4 MHz. (Use FET probe)
NOK
Go to RF troubleshooting of VCTCXO.
OK
Run Bluetooth self tests except ST_BT_SLPCLK_TEST
NOK
Replace BT ASIC (N6030)
OK
A
A
Check Sleepclk R6034. Sleepclk = 32.768 KHz, 1.8Vpp and/or run ST_BT_SLPCLK_TEST
NOK
Go to ST_SLEEPCLK_FREQ_TEST troubleshooting
OK
Turn BT on in Phoenix, Set the phone to Test mode, Select Testing > Bluetooth Locals > Run BER test
Is BER ≤ 1%?
NO
Go to Bluetooth troubleshooting part 3.
YES
Done BT is OK.

Part 3: Bluetooth self test passed but BER test failed


Bluetooth BER failure
Visuallly check BT antenna. Is it attached properly to the mechanics?
NOK
Replace BT antenna (X6030)
OK
Try to make connection to the BT box. Connection OK?
NOK
Check RF matching components/soldering: C6051, C6052, L6030, L6031, N6030, L6032, & C6032
Replace Balanced Filter (Z6030)
OK
Is BER ≤ 1% ?
NO
Ensure BT box is close enough and no interference exists and retest.
YES
Done BT is OK.

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Create a request file.

- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

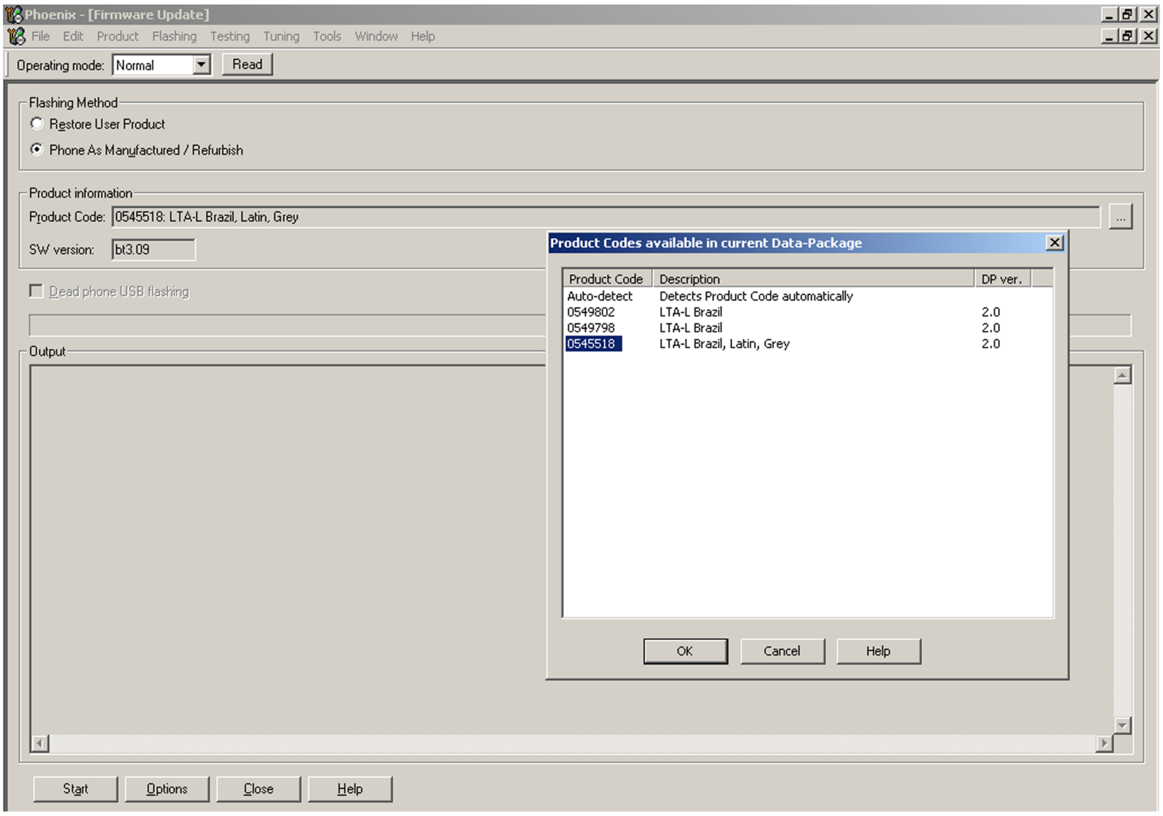
- *Phoenix* service software v 2007.04 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: FPS-10 has an integrated smart card reader.
- Activated FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-10.
   ii Update the phone MCU software to the latest available version.
   If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   iii Choose the product manually from **File→Open Product** , and click **OK**.
   Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   iv Go to **Flashing→Firmware Update** and wait until *Phoenix* reads the product data as shown in the following picture.


Phoenix - [Firmware Update]
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Read
Flashing Method
Product information
Dead phone USB flashing
Output
Product Codes available in current Data-Package
OK
Cancel
Help
Start
Options
Close
Help

Operating mode: Normal

Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish

Product Code: 0545518: LTA-L Brazil, Latin, Grey

SW version: bt3.09

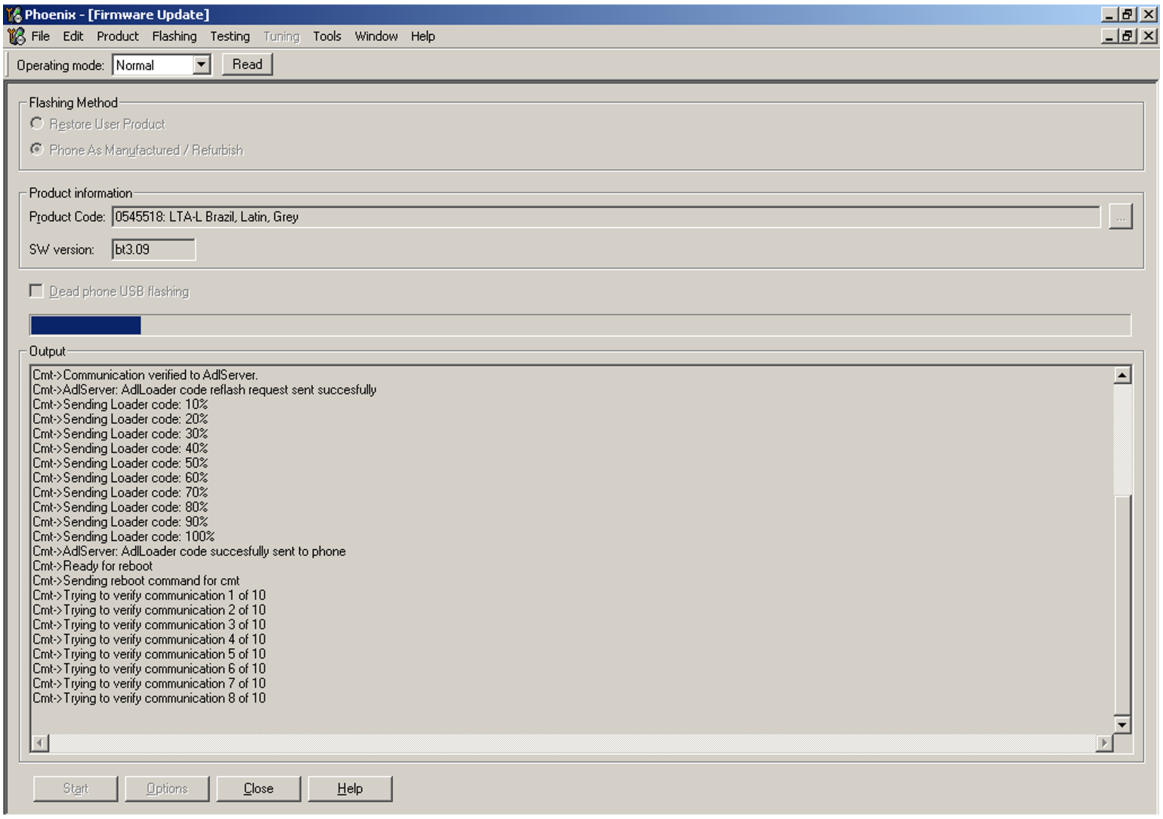
☐ Dead phone USB flashing

Product Codes available in current Data-Package

Product Code	Description	DP ver.
Auto-detect	Detects Product Code automatically	
0549802	LTA-L Brazil	2.0
0549798	LTA-L Brazil	2.0
0545518	LTA-L Brazil, Latin, Grey	2.0

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.


Phoenix - [Firmware Update]
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Read
Flashing Method
Product information
Dead phone USB flashing
Output
Start
Options
Close
Help

Operating mode: Normal

Flashing Method
○ Restore User Product
● Phone As Manufactured / Refurbish

Product Code: 0545518: LTA-L Brazil, Latin, Grey

SW version: bt3.09

☐ Dead phone USB flashing

```
Cmt->Communication verified to AdlServer.
Cmt->AdlServer: AdlLoader code reflash request sent succesfully
Cmt->Sending Loader code: 10%
Cmt->Sending Loader code: 20%
Cmt->Sending Loader code: 30%
Cmt->Sending Loader code: 40%
Cmt->Sending Loader code: 50%
Cmt->Sending Loader code: 60%
Cmt->Sending Loader code: 70%
Cmt->Sending Loader code: 80%
Cmt->Sending Loader code: 90%
Cmt->Sending Loader code: 100%
Cmt->AdlServer: AdlLoader code succesfully sent to phone
Cmt->Ready for reboot
Cmt->Sending reboot command for cmt
Cmt->Trying to verify communication 1 of 10
Cmt->Trying to verify communication 2 of 10
Cmt->Trying to verify communication 3 of 10
Cmt->Trying to verify communication 4 of 10
Cmt->Trying to verify communication 5 of 10
Cmt->Trying to verify communication 6 of 10
Cmt->Trying to verify communication 7 of 10
Cmt->Trying to verify communication 8 of 10
```

Programming is completed when Flashing Completed message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

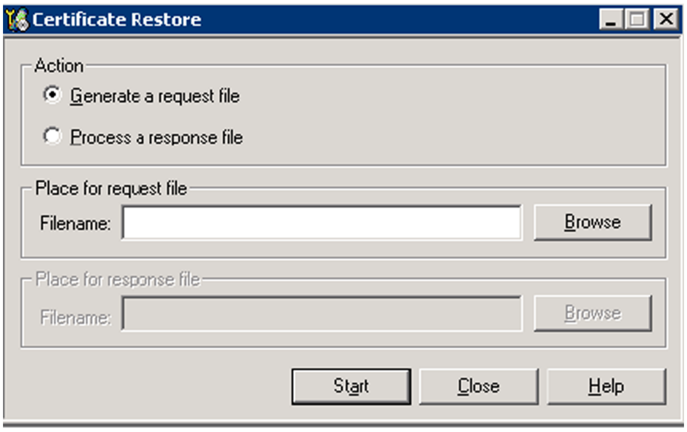
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

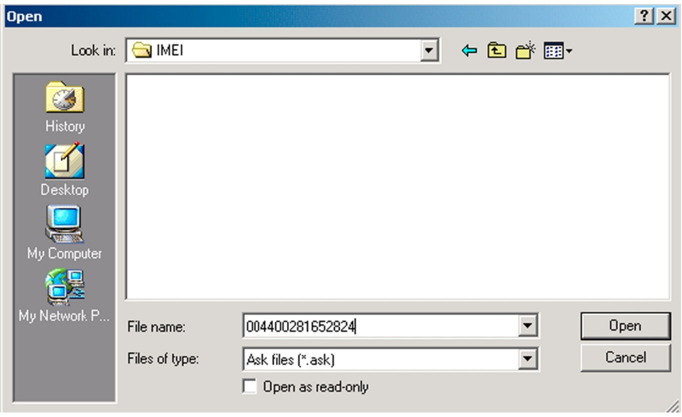
iii To choose a location for the request file, click **Browse**.


Certificate Restore
Action
Place for request file
Browse
Place for response file
Filename:
Browse
Start
Close
Help

Action: ● Generate a request file ○ Process a response file

Filename:

iv Name the file so that you can easily identify it, and click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

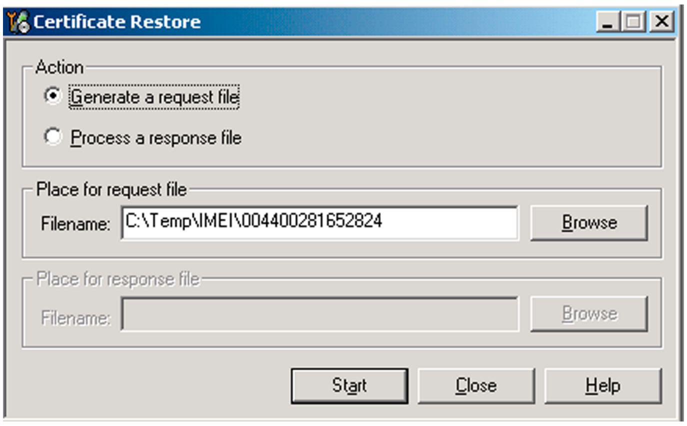
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Action
Place for request file
Browse
Place for response file
Filename:
Browse
Start
Close
Help

Action: ● Generate a request file ○ Process a response file

Filename: C:\Temp\IMEI\004400281652824

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

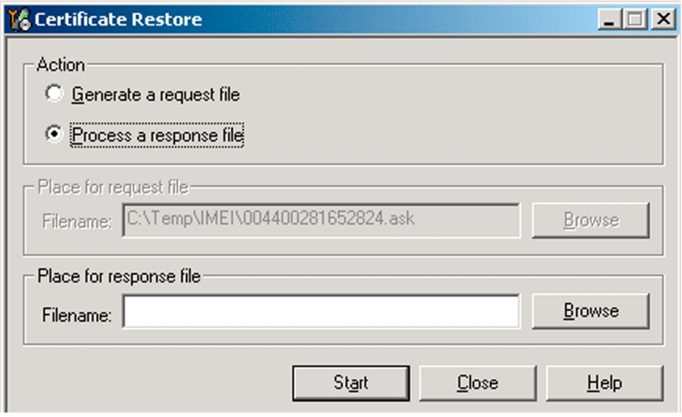
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.


Certificate Restore
Action
Place for request file
Place for response file
Browse
Browse
Start
Close
Help

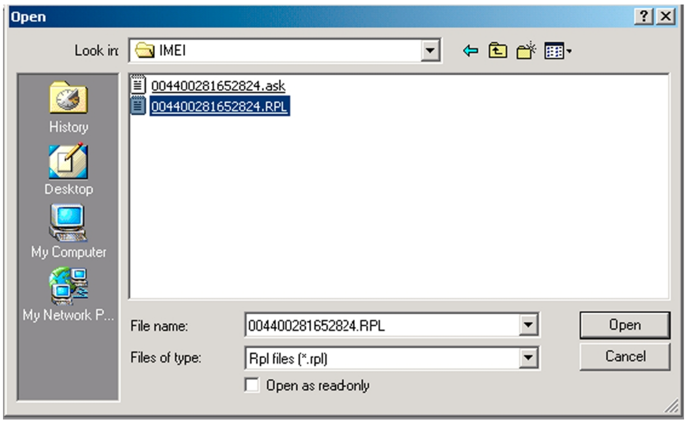
Action:
○ Generate a request file
● Process a response file

Place for request file — Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file — Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

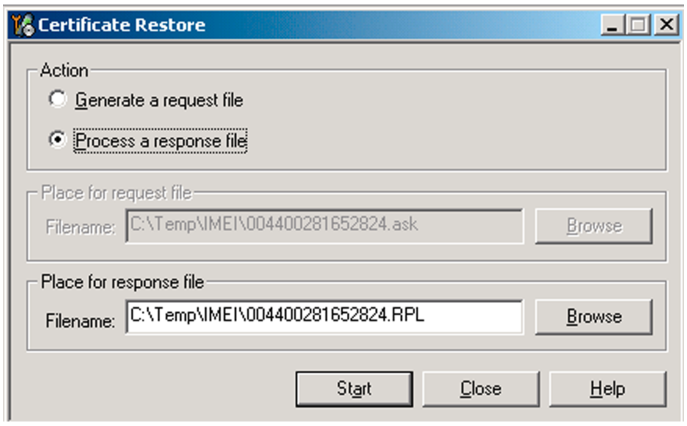
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.



Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File→ Scan Product.**
4. Choose **Tuning→Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Tune**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 9 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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4 — RF troubleshooting

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General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RF IC N7505
- TXFEM N7520
- DC/DC Converter N7590
- Tx Saw GSM 850/900 Z7503
- Rx Saw GSM 1800/1900 Z7501

Note: Please review the appropriate process for storage and handling of these components prior to soldering.

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

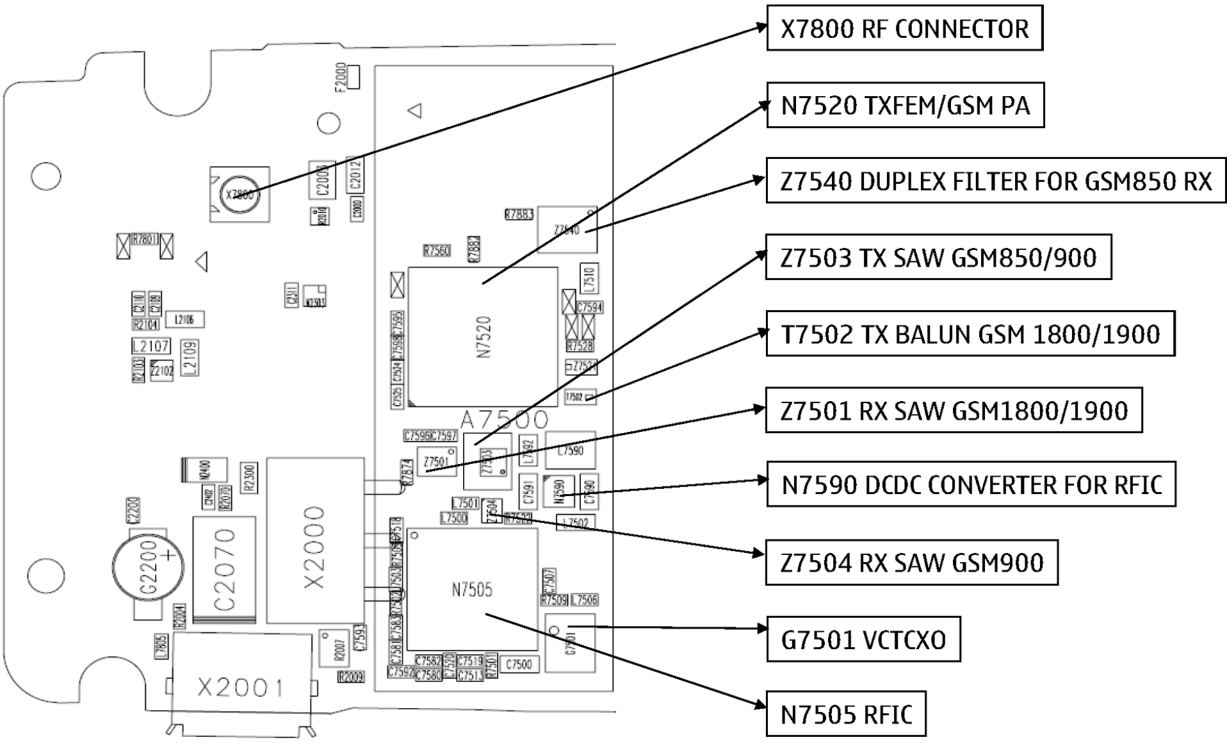
- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

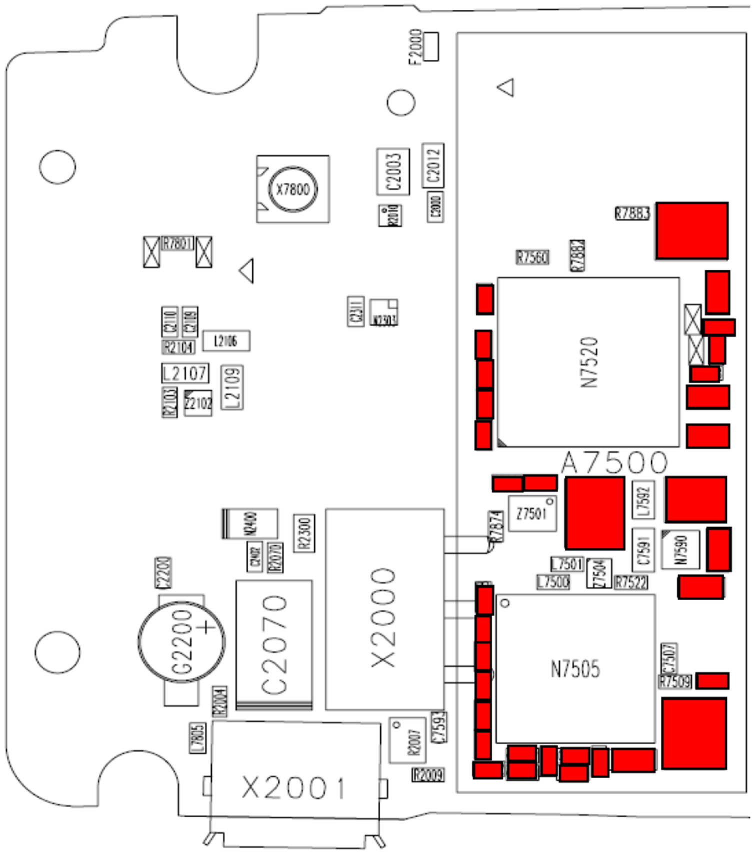
The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible, i.e. not replaceable. Please refer to the list of Non-replaceable RF components (page 4–6).

RF key components


X7800 RF CONNECTOR
N7520 TXFEM/GSM PA
Z7540 DUPLEX FILTER FOR GSM850 RX
Z7503 TX SAW GSM850/900
T7502 TX BALUN GSM 1800/1900
Z7501 RX SAW GSM1800/1900
N7590 DCDC CONVERTER FOR RFIC
Z7504 RX SAW GSM900
G7501 VCTCXO
N7505 RFIC
X7800
N7520
A7500
N7505
X2000
X2001
C2070
G2200
F2000
L2107
L2109

Non-replaceable RF components

The following RF components cannot be replaced because of their location on the PWB:


F2000
X7800
C2003
C2012
R7801
R7883
R7560
R7882
N7520
A7500
L2106
L2107
L2109
R2104
Z2102
Z7501
R7874
L7592
N2400
R2300
X2000
C2070
G2200
C2200
L7591
N7590
L7501
L7500
Z7504
R7522
N7505
C7507
R7509
R2004
L7805
R2007
L7593
R2009
X2001

Non-replaceable RF components:

C7500
C7513
C7518
C7519
C7520
C7524
C7525
C7580
C7581
C7582
C7583
C7590
C7592
C7594
C7595
C7596
C7597
C7598
G7501
L7502
L7503
L7506
L7510
L7590
R7501
R7502
R7503
R7528
T7502
Z7503
Z7521
Z7540

Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: RF cable, USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

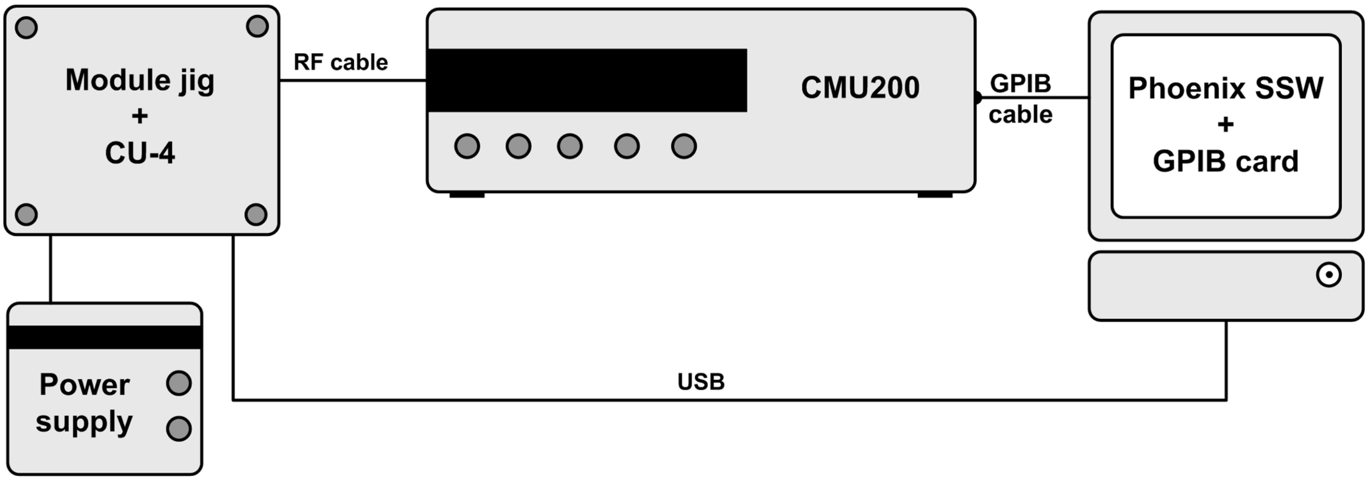

Module jig
+
CU-4
RF cable
CMU200
GPIB cable
Phoenix SSW
+
GPIB card
Power supply
USB

Figure 12 Auto tuning concept with CMU200

Phoenix preparations

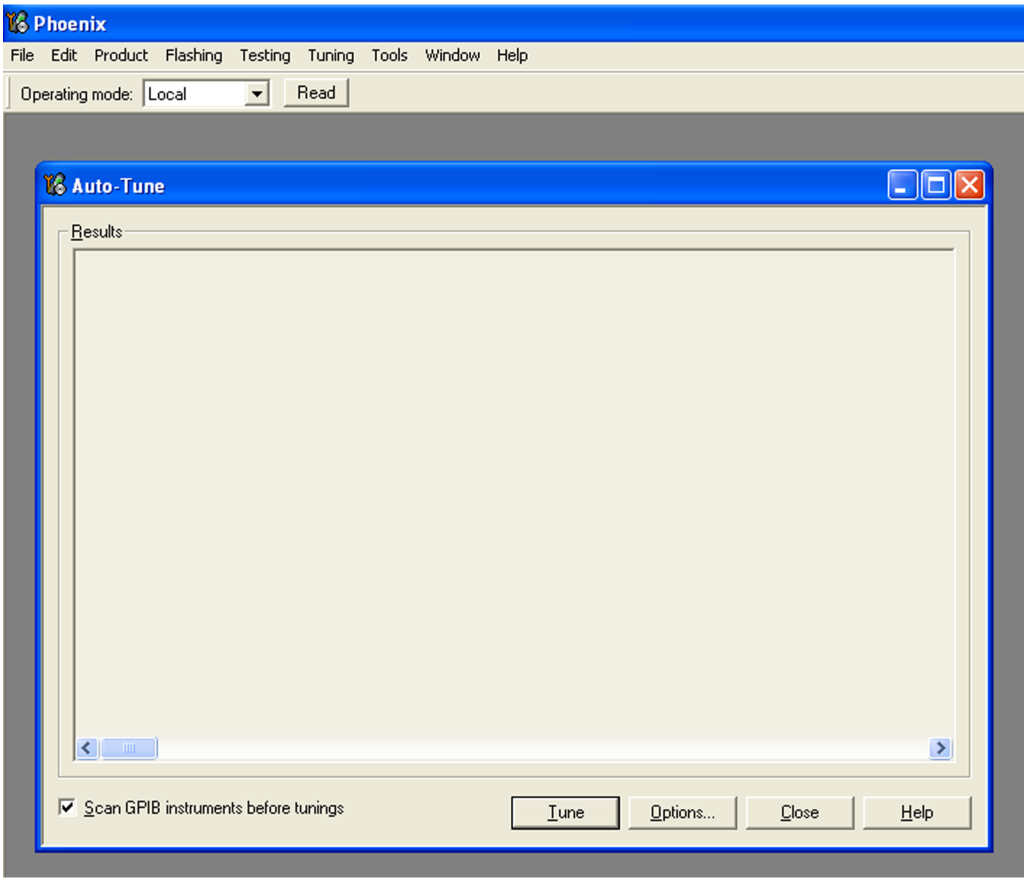
Install the phone specific data package, for example *RM-429_xxxxx.exe*. This defines phone specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Start autotuning, clicking the *Tune* button.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Auto-Tune
Results
Tune
Options...
Close
Help

Operating mode: Local

☑ Scan GPIB instruments before tunings

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	L7502	3.2 V
3	TXFEM supply	L7510	3.9 V
6	Supply to AHNEUS DC/DC conv	L7592	3.9 V

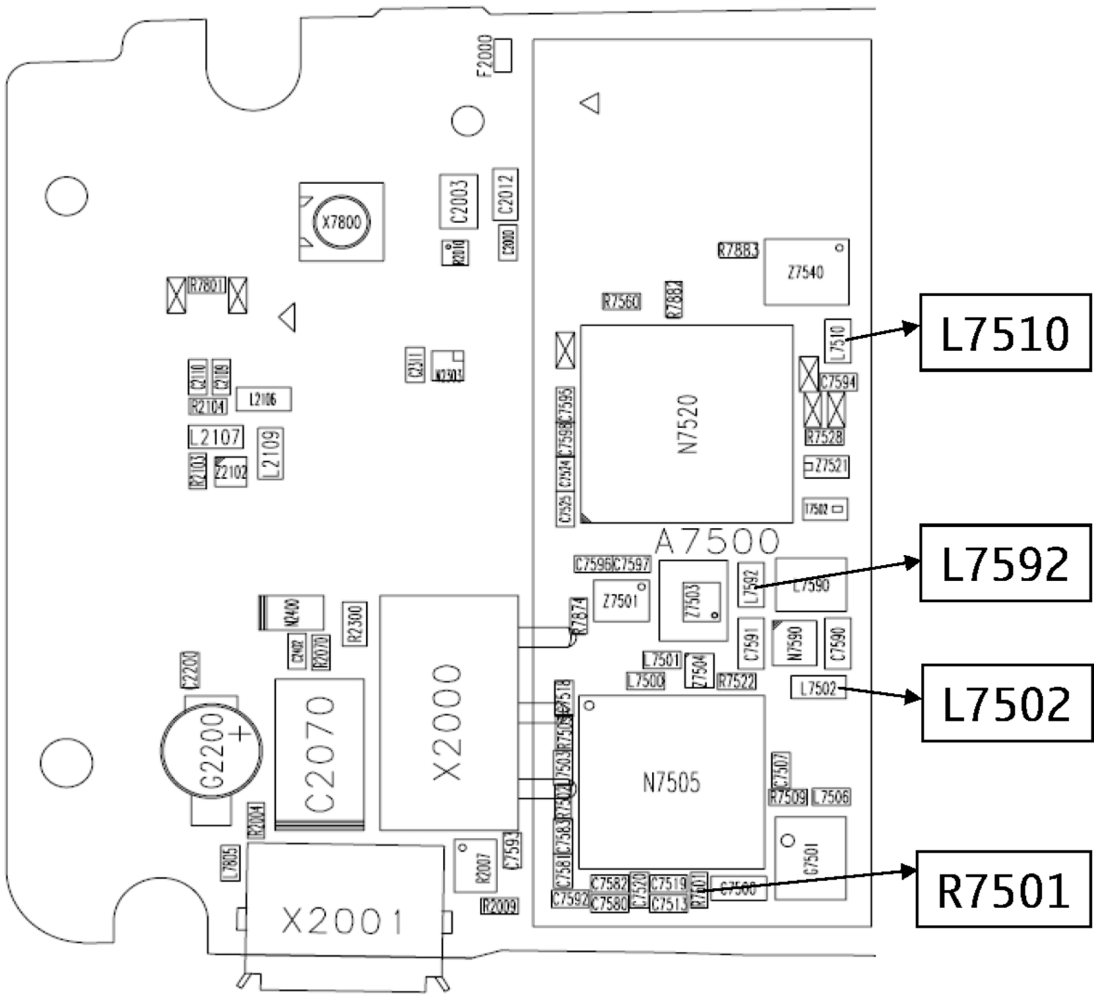
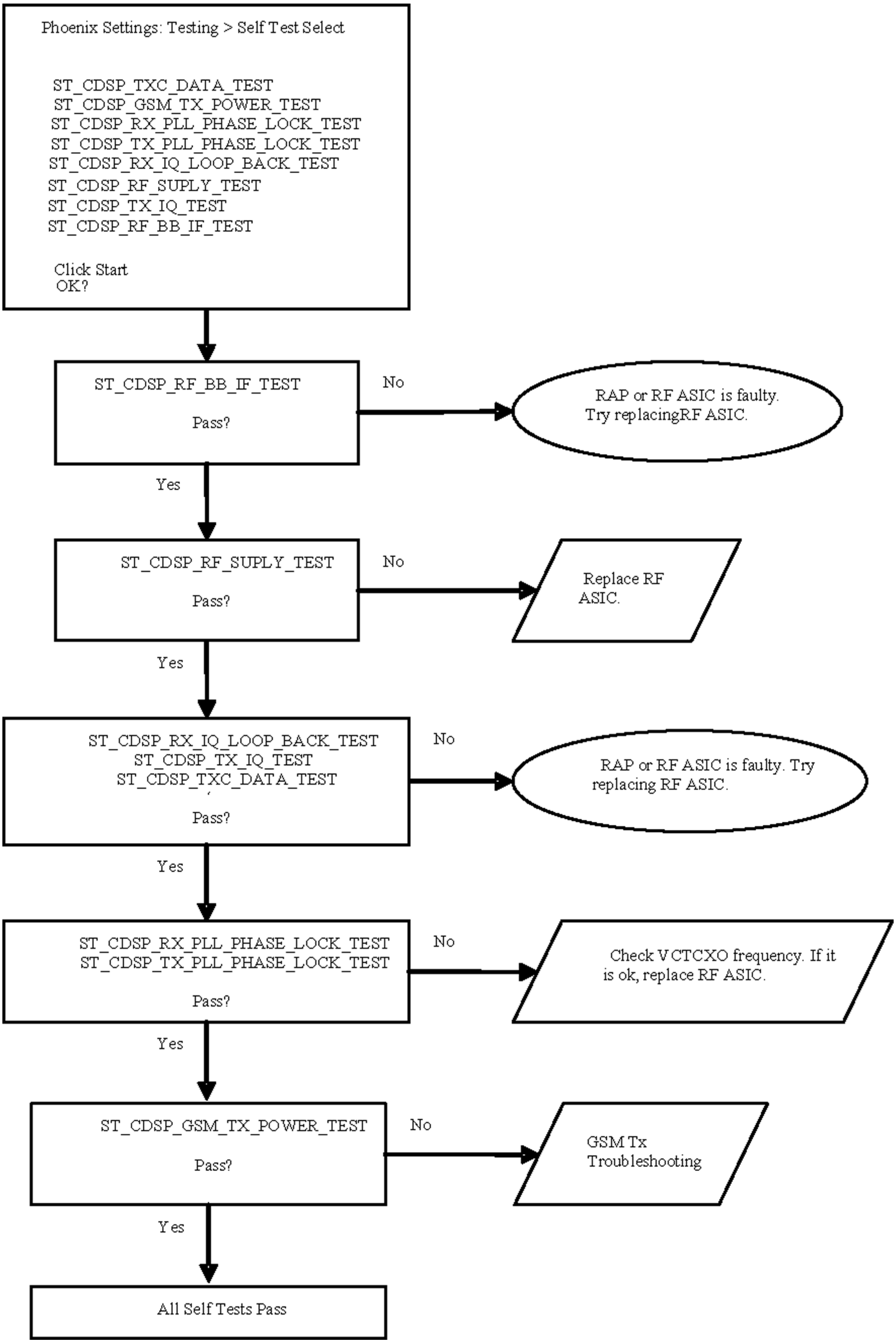

L7510
L7592
L7502
R7501
A7500
N7520
N7505
X2000
X2001
C2070
G2200
X7800
F2000
C2003
C2012
Z7540
R7883
R7560
R7882
Z7501
Z7503
L7590
L7501
L7500
R7522
R7528
Z7521
C7594
C7596
C7597
R7874
L7506
R7509
G7501
C7500
L2107
L2109
L2106
R2104
R2103
Z2102
R7801
R2300
C2200
R2009
R2007

Figure 13 General voltage checking test points (main board, top side)

■ Self test troubleshooting

Troubleshooting flow


Phoenix Settings: Testing > Self Test Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_RF_SUPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click Start
OK?
ST_CDSP_RF_BB_IF_TEST
Pass?
No
RAP or RF ASIC is faulty.
Try replacingRF ASIC.
Yes
ST_CDSP_RF_SUPLY_TEST
Pass?
No
Replace RF ASIC.
Yes
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_TXC_DATA_TEST
Pass?
No
RAP or RF ASIC is faulty. Try replacing RF ASIC.
Yes
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
Pass?
No
Check VCTCXO frequency. If it is ok, replace RF ASIC.
Yes
ST_CDSP_GSM_TX_POWER_TEST
Pass?
No
GSM Tx Troubleshooting
Yes
All Self Tests Pass

Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements/GSM RSSI measurement (page 4–11).

GSM RX chain activation for manual measurements/GSM RSSI measurement

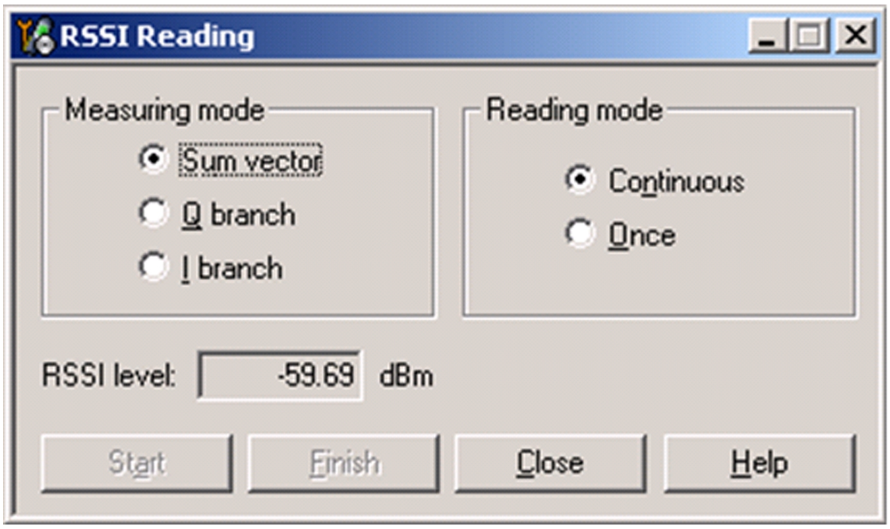
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71KHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode: ● Sum vector ○ Q branch ○ I branch

Reading mode: ● Continuous ○ Once

RSSI level: -59.69 dBm

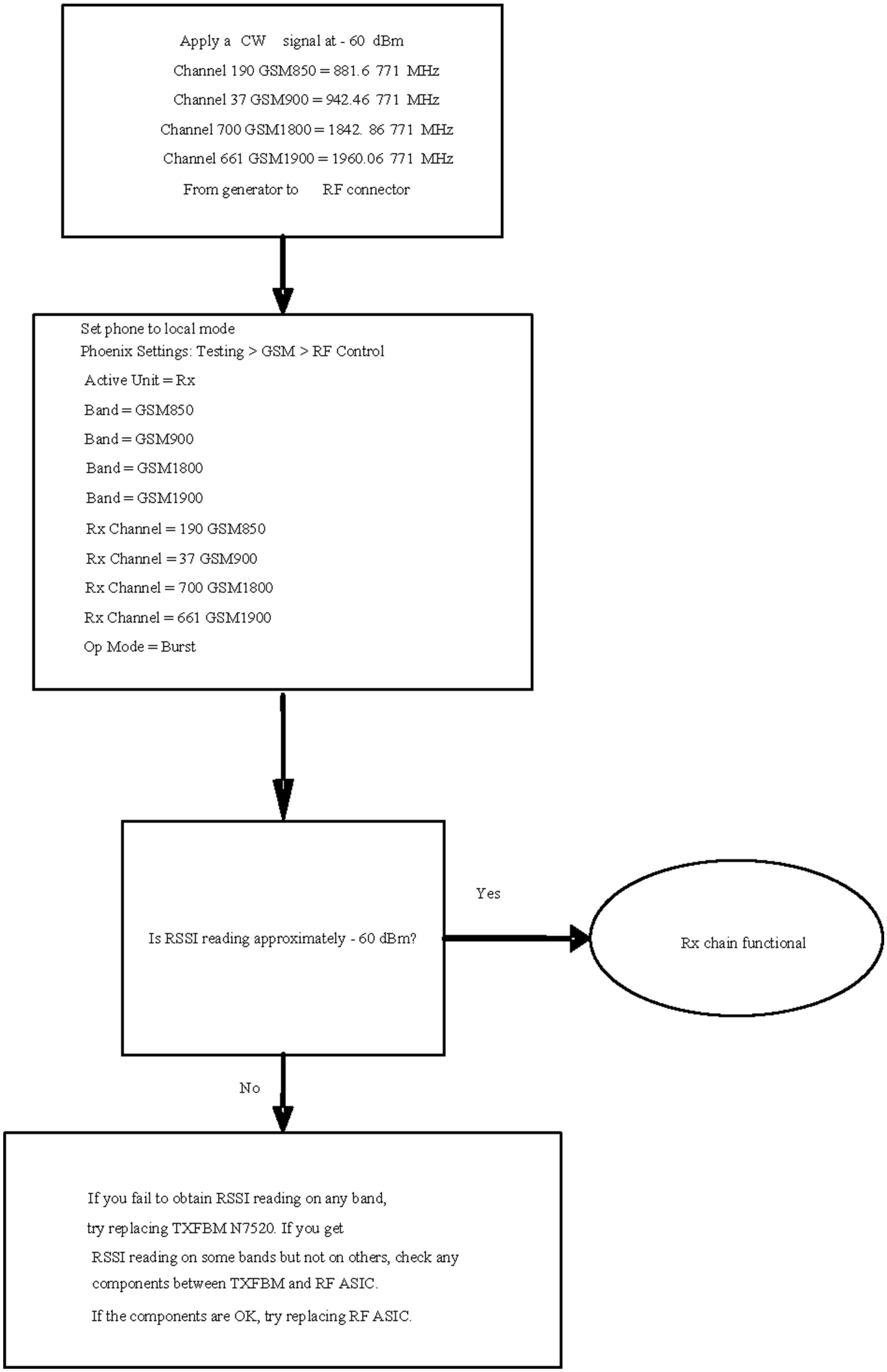
Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

GSM receiver troubleshooting flowchart

Troubleshooting flow



Apply a CW signal at - 60 dBm
Channel 190 GSM850 = 881.6 771 MHz
Channel 37 GSM900 = 942.46 771 MHz
Channel 700 GSM1800 = 1842. 86 771 MHz
Channel 661 GSM1900 = 1960.06 771 MHz
From generator to RF connector

Set phone to local mode
Phoenix Settings: Testing > GSM > RF Control
Active Unit = Rx
Band = GSM850
Band = GSM900
Band = GSM1800
Band = GSM1900
Rx Channel = 190 GSM850
Rx Channel = 37 GSM900
Rx Channel = 700 GSM1800
Rx Channel = 661 GSM1900
Op Mode = Burst

Is RSSI reading approximately - 60 dBm?

If you fail to obtain RSSI reading on any band, try replacing TXFBM N7520. If you get RSSI reading on some bands but not on others, check any components between TXFBM and RF ASIC.

If the components are OK, try replacing RF ASIC.

Transmitter troubleshooting

Introduction to transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

> **Note:** Never activate the GSM transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

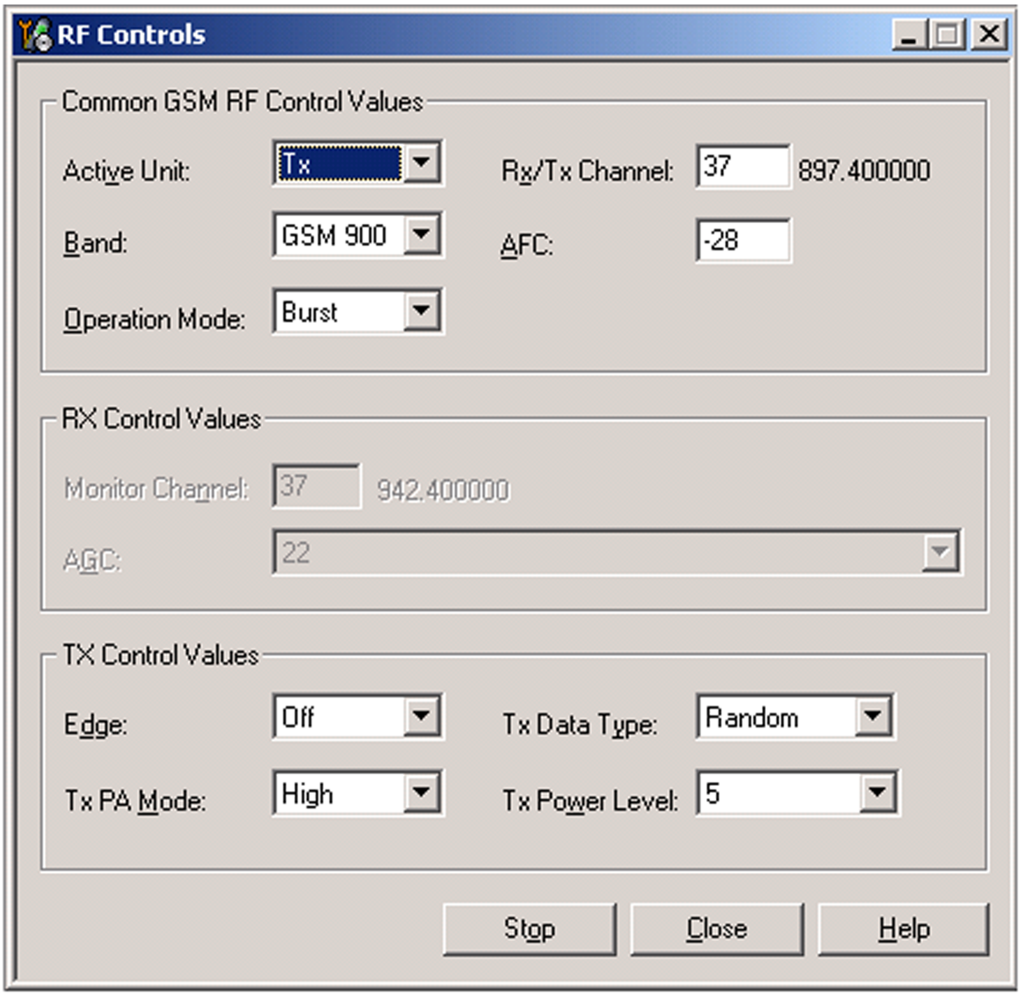
Prerequisites

Always start troubleshooting the lowest band, e.g. GSM850.

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Set RF controls as shown in the figure below. GSM900 is used for this example.



RF Controls

Common GSM RF Control Values

Active Unit: Tx

Rx/Tx Channel: 37 897.400000

Band: GSM 900

AFC: -28

Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx Data Type: Random

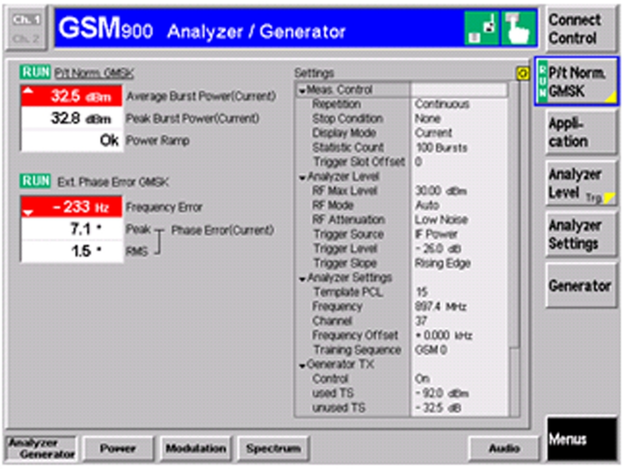
Tx PA Mode: High

Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

   Note: Frequency error is common as there is no automatic AFC control. It can be adjusted using the AFC input box.

Analyser settings


GSM900 Analyzer / Generator
Connect Control
P/t Norm. GMSK
Application
Analyzer Level
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

RUN P/t Norm. GMSK

32.5 dBm Average Burst Power(Current)
32.8 dBm Peak Burst Power(Current)
Ok Power Ramp

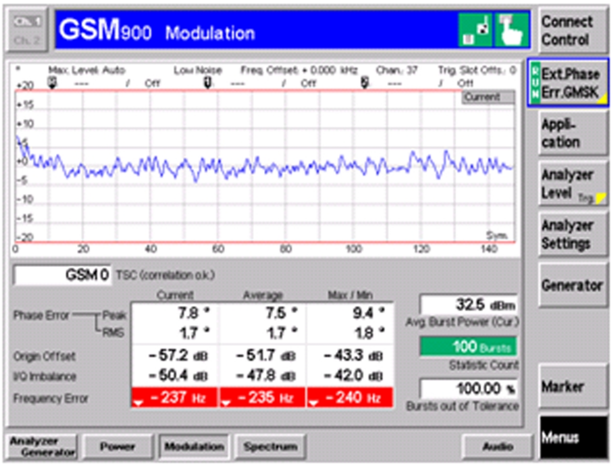
RUN Ext. Phase Error GMSK

-233 Hz Frequency Error
7.1 ° Peak – Phase Error(Current)
1.5 ° RMS

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	-25.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	On
used TS	-92.0 dBm
unused TS	-32.5 dB

Phase error

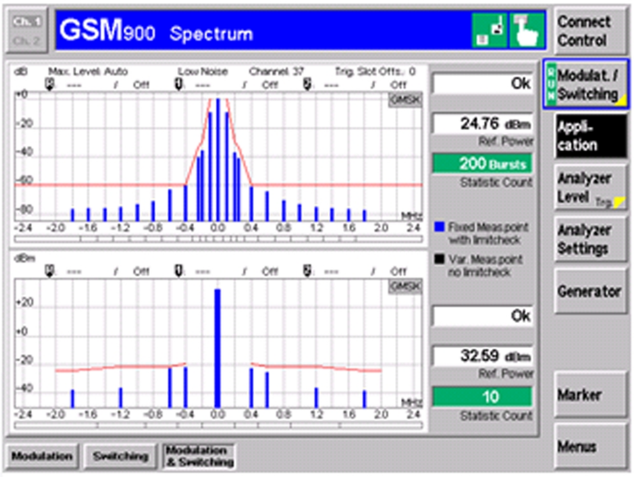

GSM900 Modulation
Connect Control
Ext.Phase Err.GMSK
Application
Analyzer Level
Analyzer Settings
Generator
Marker
Menus
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Current
+20
+15
+10
+5
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		-57.2 dB	-51.7 dB	-43.3 dB
I/Q Imbalance		-50.4 dB	-47.8 dB	-42.0 dB
Frequency Error		-237 Hz	-235 Hz	-240 Hz

32.5 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

Modulation/Switching spectrum

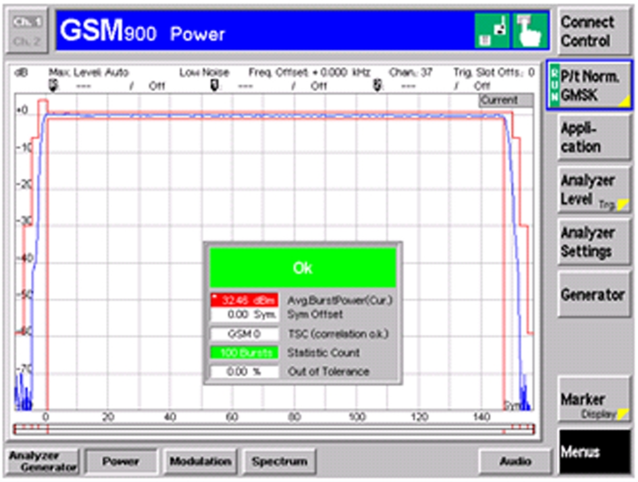

GSM900 Spectrum
Connect Control
Modulat. / Switching
Application
Analyzer Level
Analyzer Settings
Generator
Marker
Menus
Max. Level: Auto
Low Noise
Channel: 37
Trig. Slot Offs.: 0
GMSK
dB
dBm
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
Modulation
Switching
Modulation & Switching

Ok
24.76 dBm Ref. Power
200 Bursts Statistic Count

🟦 Fixed Meas.point with limitcheck
⬛ Var. Meas.point no limitcheck

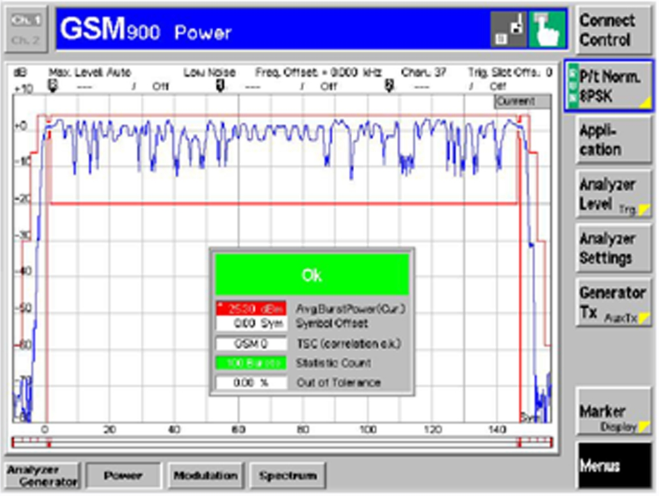
Ok
32.59 dBm Ref. Power
10 Statistic Count

Power/Burst


GSM900 Power
Connect Control
P/t Norm. GMSK
Application
Analyzer Level
Analyzer Settings
Generator
Marker Display
Menus
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Current
dB
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

Ok
32.46 dBm Avg.BurstPower(Cur.)
0.00 Sym. Sym.Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Edge


GSM900 Power
Connect Control
P/t Norm. 8PSK
Application
Analyzer Level
Analyzer Settings
Generator Tx
Marker Display
Menus
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Current
dB
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum

Ok
25.20 dBm AvgBurstPower(Cur.)
0.00 Sym. Symbol Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Figure 14 Typical readings

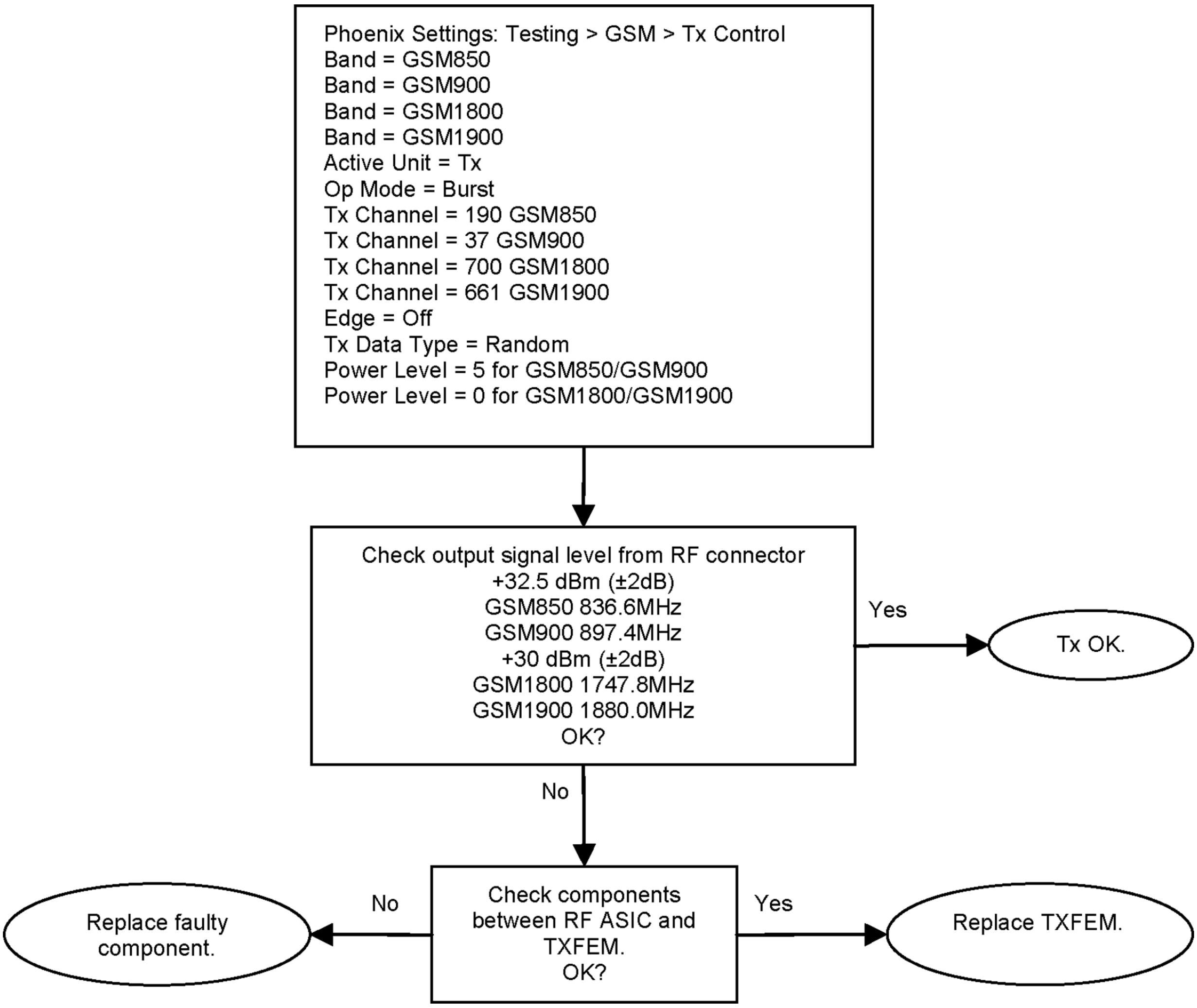
4. Change power level (RF controls) and make sure the power reading follows accordingly.

Next actions

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

GSM transmitter troubleshooting flowchart

Troubleshooting flow


Phoenix Settings: Testing > GSM > Tx Control
Band = GSM850
Band = GSM900
Band = GSM1800
Band = GSM1900
Active Unit = Tx
Op Mode = Burst
Tx Channel = 190 GSM850
Tx Channel = 37 GSM900
Tx Channel = 700 GSM1800
Tx Channel = 661 GSM1900
Edge = Off
Tx Data Type = Random
Power Level = 5 for GSM850/GSM900
Power Level = 0 for GSM1800/GSM1900
Check output signal level from RF connector
+32.5 dBm (±2dB)
GSM850 836.6MHz
GSM900 897.4MHz
+30 dBm (±2dB)
GSM1800 1747.8MHz
GSM1900 1880.0MHz
OK?
Yes
Tx OK.
No
Check components between RF ASIC and TXFEM.
OK?
No
Replace faulty component.
Yes
Replace TXFEM.

5 — System Module

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Introduction

Phone description

RAP3GS is the main digital baseband ASIC in the phone. It contains functionality for GSM EDGE. Camera hardware accelerator is used as a co-processor.

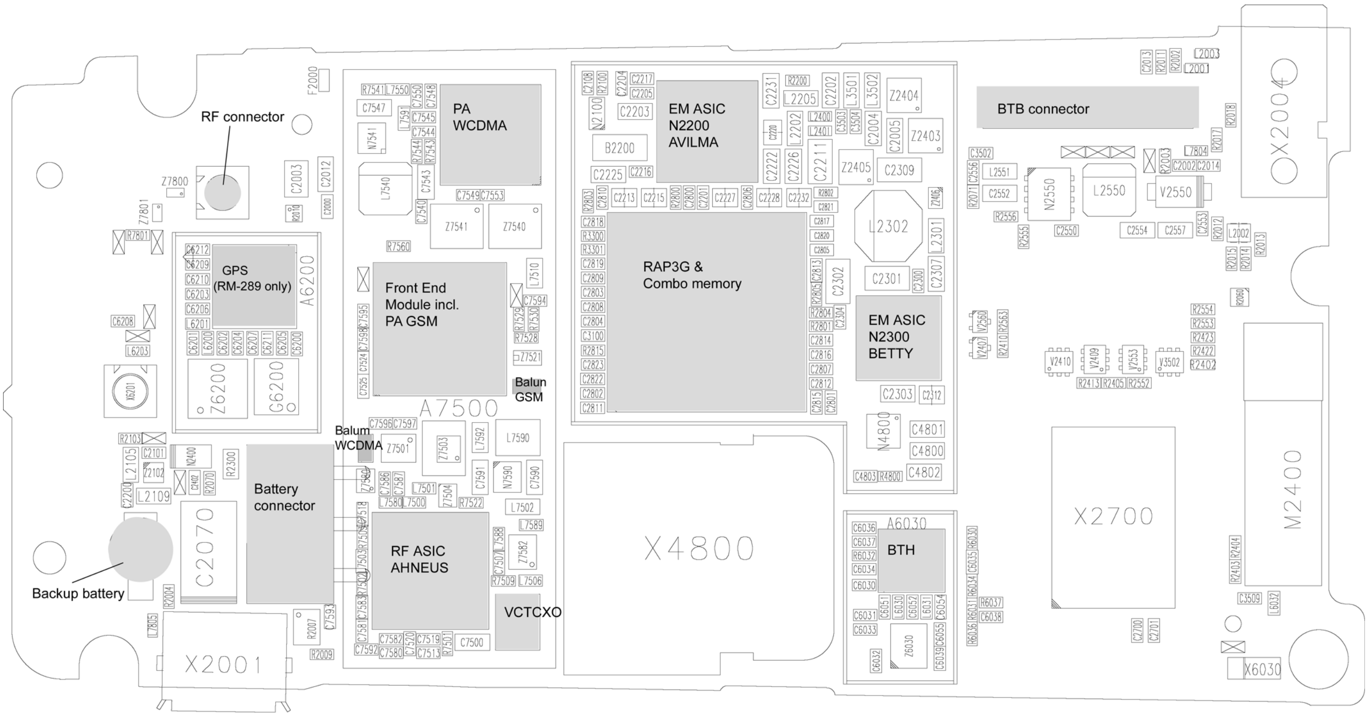
N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Bluetooth is physically integrated in one single ASIC.

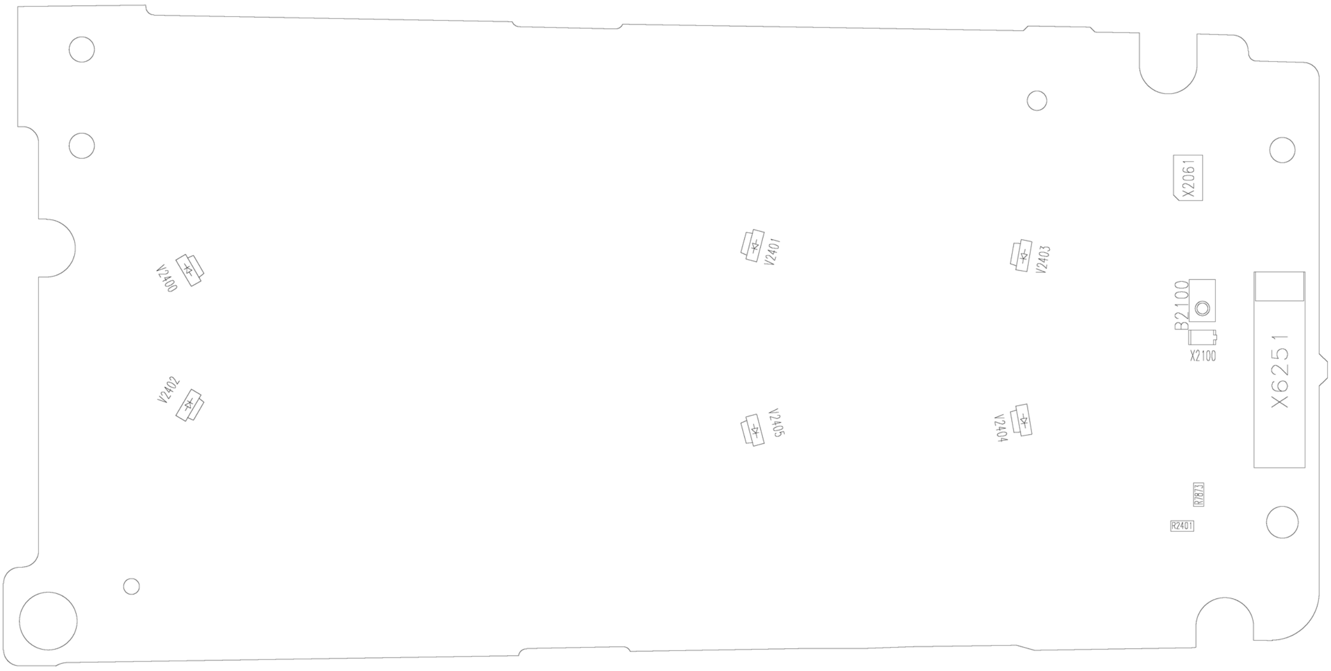
Key components

Function	Description	Item ref
Baseband ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RAP3GS	D2800
Co-processor	Camera hardware accelerator	D6601
PA GSM	Front end module (FEM), quad band	N7520
Oscillators	VCTCXO Balun GSM	G7501 T7502
Memories	512 Mbit NOR + 256 Mbit SDRAM Combo (Stacked with RAP3GS)	D2801
Back-up battery	RTC back-up battery 311	G2200
Bluetooth	BTPerf 2.3 module	N6030
Fold switch	Hall IC switch/position sensor	N2400
Battery	BL-5C	
Battery connector	Conn. battery 3POL SPR	X2000
BTB connector	Board-to-board connector	Main: X3502, Top: X3602
RF connector		X7800

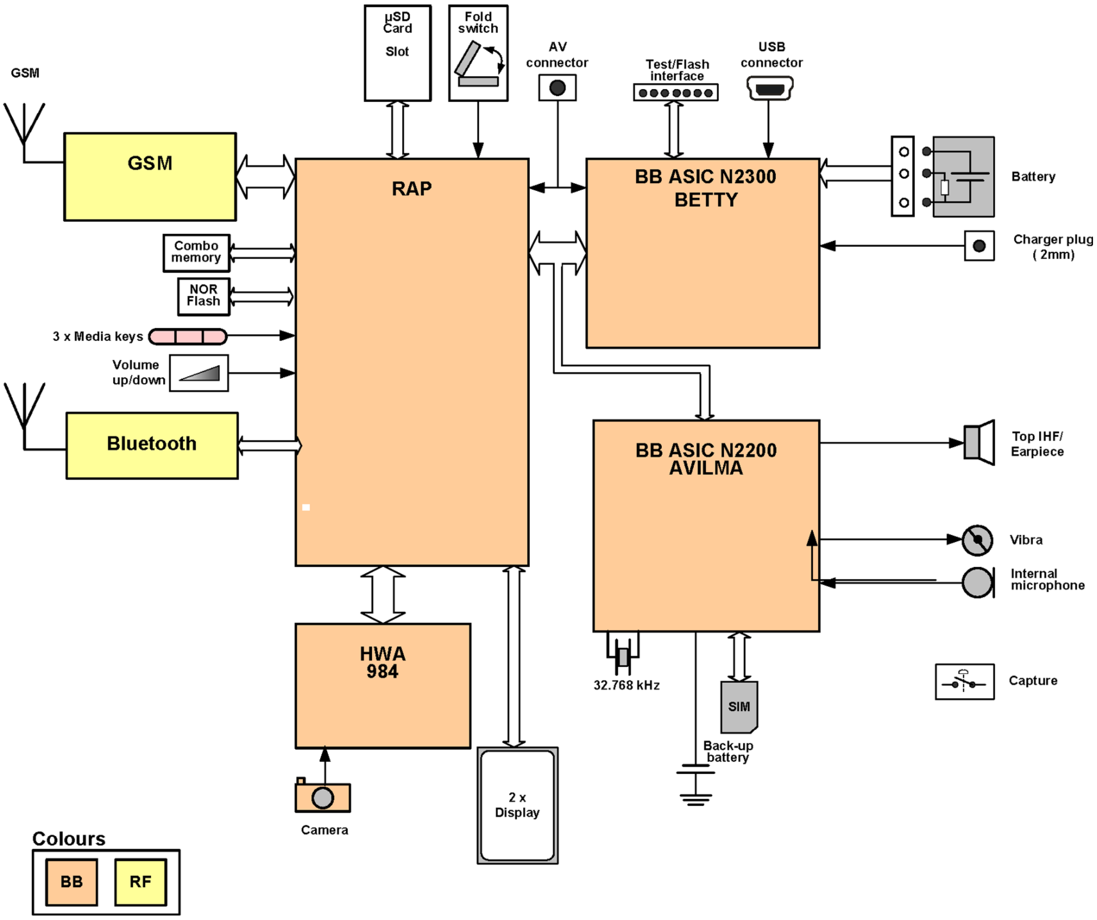
Key component placement top side


RF connector
GPS
(RM-289 only)
A6200
Z6200
G6200
PA
WCDMA
Front End
Module incl.
PA GSM
Balun
GSM
A7500
Balun
WCDMA
Battery
connector
RF ASIC
AHNEUS
VCTCXO
Backup battery
C2070
X2001
EM ASIC
N2200
AVILMA
RAP3G &
Combo memory
EM ASIC
N2300
BETTY
L2302
X4800
N4800
A6030
BTH
BTB connector
X2004
N2550
L2550
V2550
X2700
M2400
X6030
Z7800
F2000
C2003
C2012
R2300
L2109
L2105
Z7541
Z7540
L7510
L7590
Z2404
Z2403
Z2405
C2309
C2301
C2302
C4801
C4800
C4802
B2200

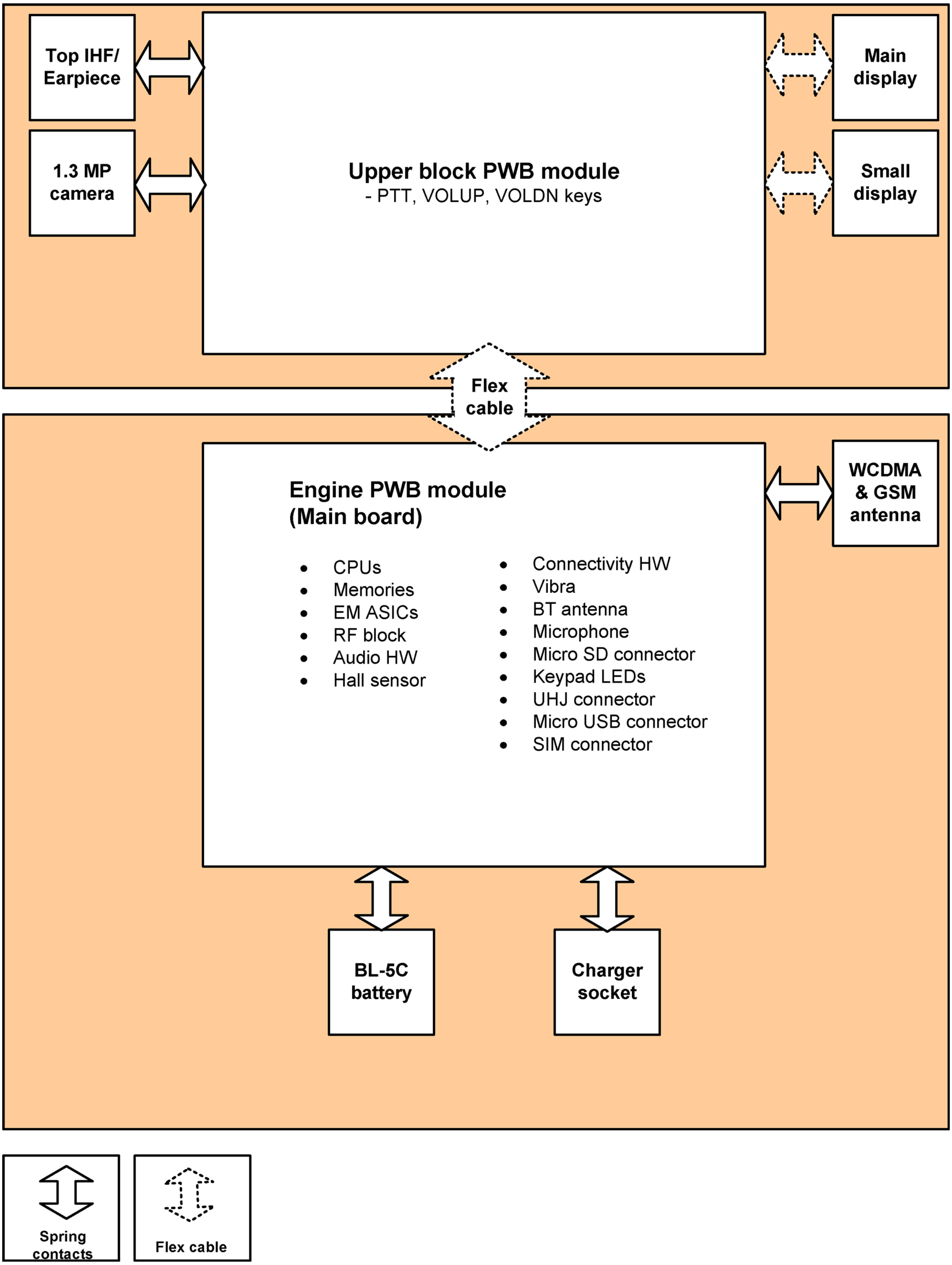
Key component placement bottom side


V2400
V2402
V2401
V2405
V2403
V2404
X2061
B2100
X2100
X6251
R2401

System module block diagram


µSD Card Slot
Fold switch
AV connector
Test/Flash interface
USB connector
GSM
GSM
RAP
BB ASIC N2300 BETTY
Battery
Charger plug (2mm)
Combo memory
NOR Flash
3 x Media keys
Volume up/down
Bluetooth
BB ASIC N2200 AVILMA
Top IHF/ Earpiece
Vibra
Internal microphone
Capture
32.768 kHz
SIM
Back-up battery
HWA 984
Camera
2 x Display
Colours
BB
RF

Board and module connections


Top IHF/ Earpiece
1.3 MP camera
Upper block PWB module
- PTT, VOLUP, VOLDN keys
Main display
Small display
Flex cable
Engine PWB module (Main board)
CPUs
Memories
EM ASICs
RF block
Audio HW
Hall sensor
Connectivity HW
Vibra
BT antenna
Microphone
Micro SD connector
Keypad LEDs
UHJ connector
Micro USB connector
SIM connector
WCDMA & GSM antenna
BL-5C battery
Charger socket
Spring contacts
Flex cable

Energy management

Battery interface

The phone is powered by a 3-pole BL-5C S-pack 1020 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

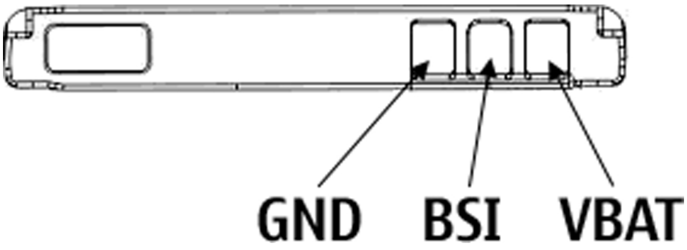


Figure 15 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a 3-pole connector.

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

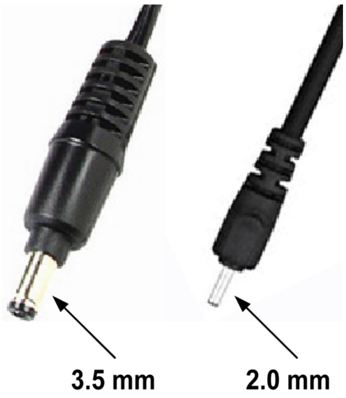


Figure 16 Small (left) and wide (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5C battery is used.

Table 10 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage	4.230	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.

Mode	Description
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAP for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAP to EM ASIC N2300. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from Ahneus ASIC to BT module.

CLK600. The clock source is an internal RC oscillator in EM ASIC N2300 (during the power-up sequence) or RAPIDO SMPS Clk.

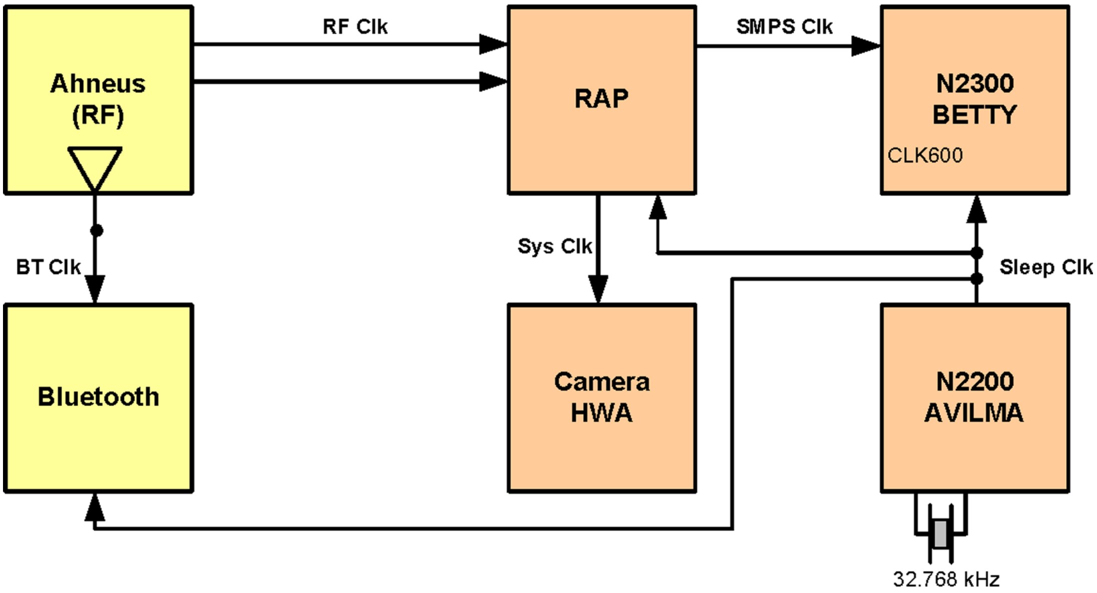


Figure 17 Clocking scheme

USB, SIM, MicroSD

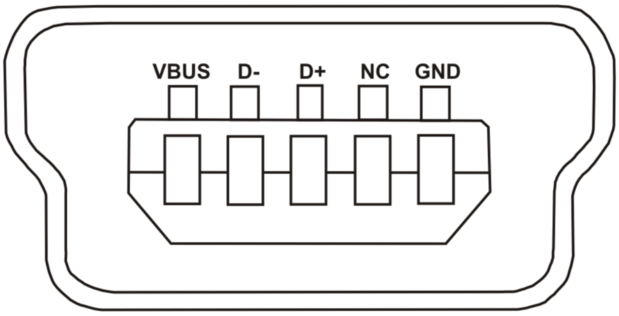
USB

USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for microUSB.


VBUS
D-
D+
NC
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

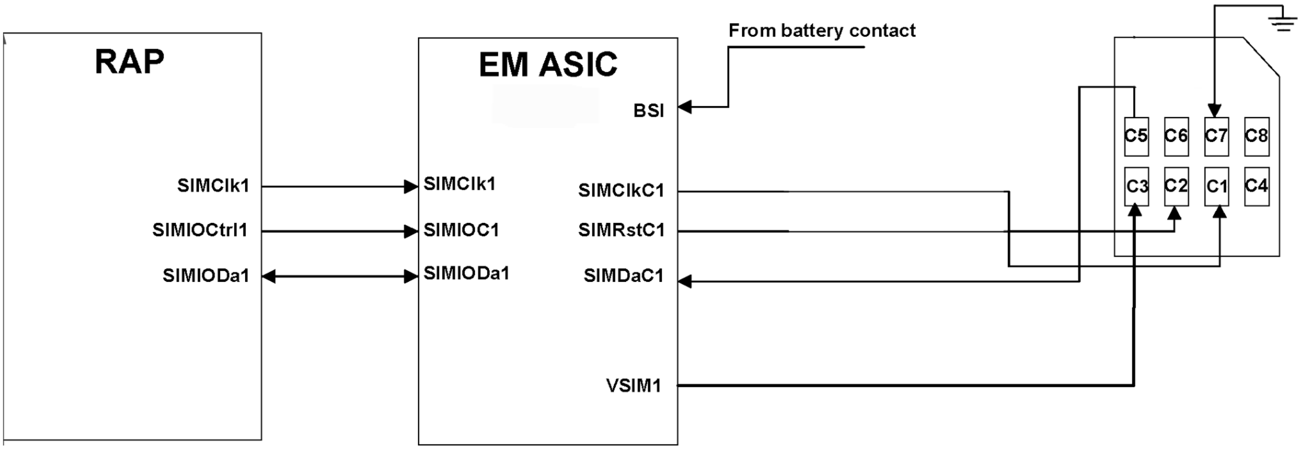
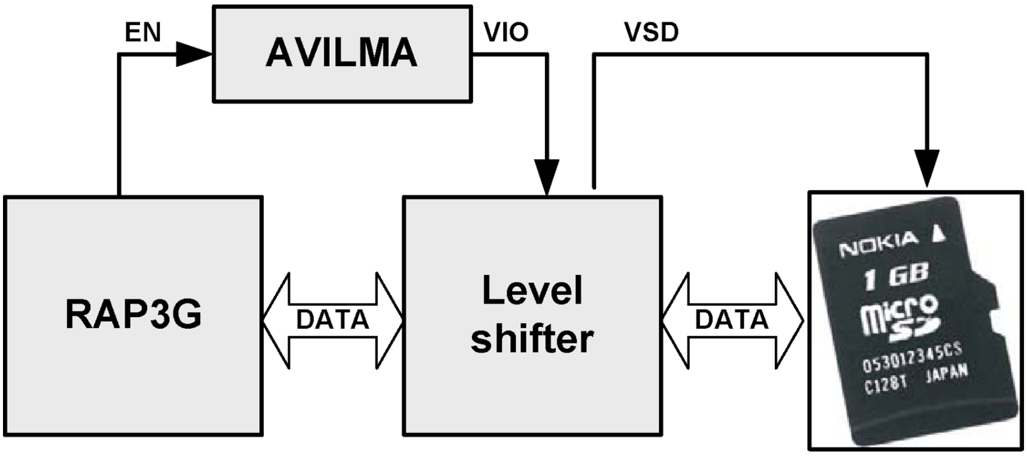

RAP
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
C5
C6
C7
C8
C3
C2
C1
C4

Figure 18 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not respond to the ATR a 3 V interface voltage is used.

µSD card interface


EN
AVILMA
VIO
VSD
RAP3G
DATA
Level shifter
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The µSD card is connected to the engine by an external level shifter. Supplied voltages:

- VSD: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

Camera

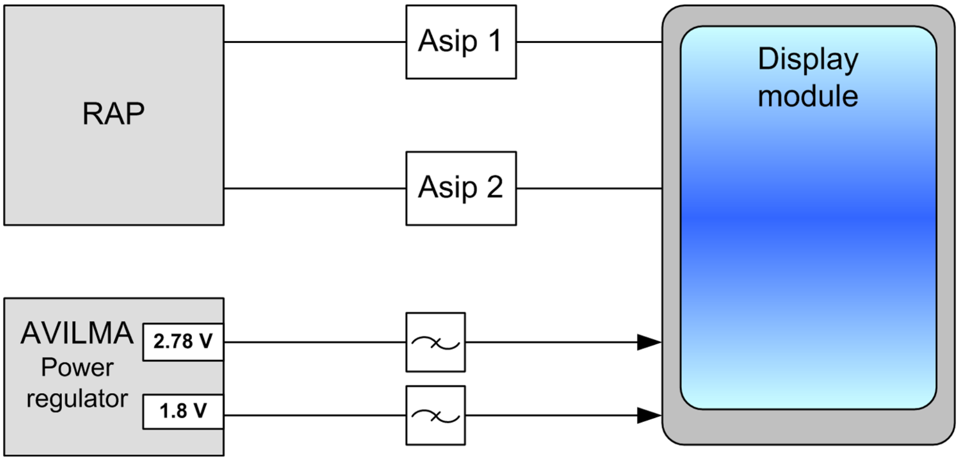
The main camera uses a 1.3 megapixel camera module. It has a dedicated capture key.

User interface

Display module

This phone has two displays; one main display and one small display. It does not require any tuning in service.

The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.


RAP
Asip 1
Asip 2
Display module
AVILMA
Power
regulator
2.78 V
1.8 V

Keyboard and other keys

Most keys are placed on the main board;

- Numeric keys
- Soft keys L/R
- Navigation keys (4) with Select in the centre

- Send and End keys
- Capture key
- Power key

Also, three volume up/down and PTT keys are placed on the top board.

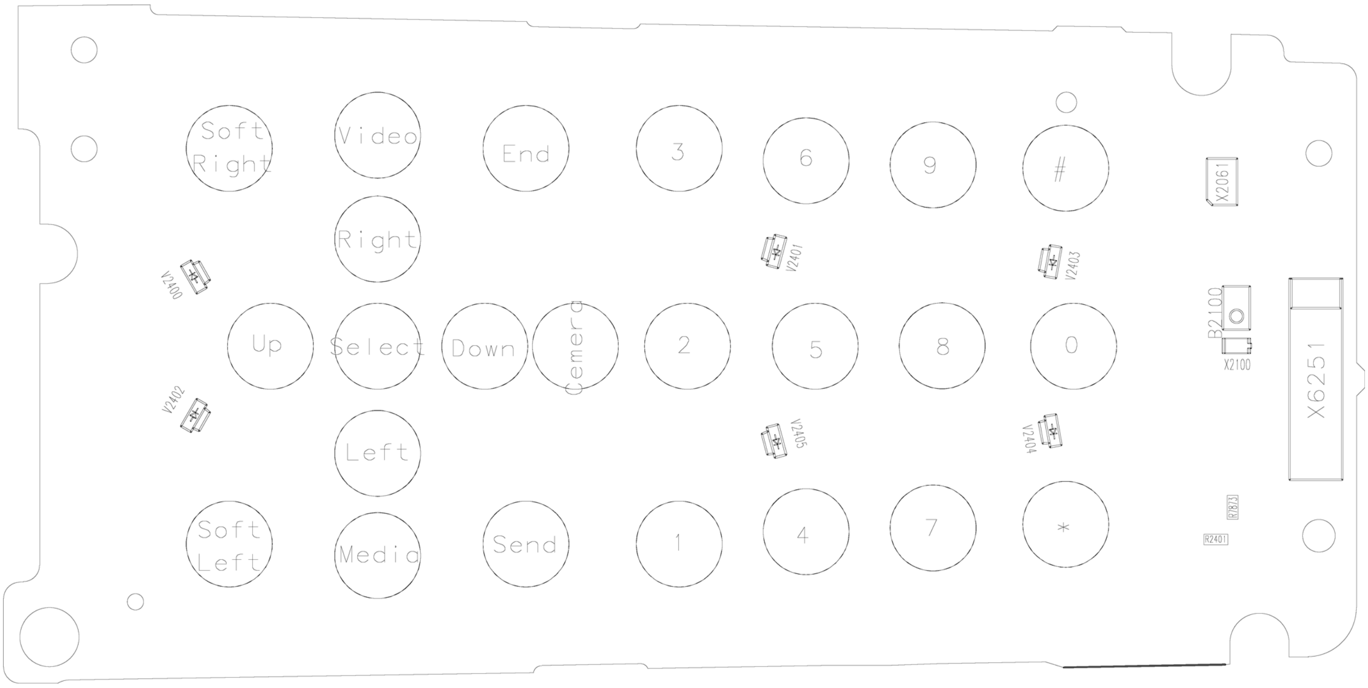

Soft Right
Video
End
3
6
9
#
X2061
Right
V2401
V2403
V2400
B2100
X2100
X6251
Up
Select
Down
Cemera
2
5
8
0
V2402
V2405
V2404
Left
R7873
R2401
Soft Left
Media
Send
1
4
7
*

Figure 19 Keyboard layout

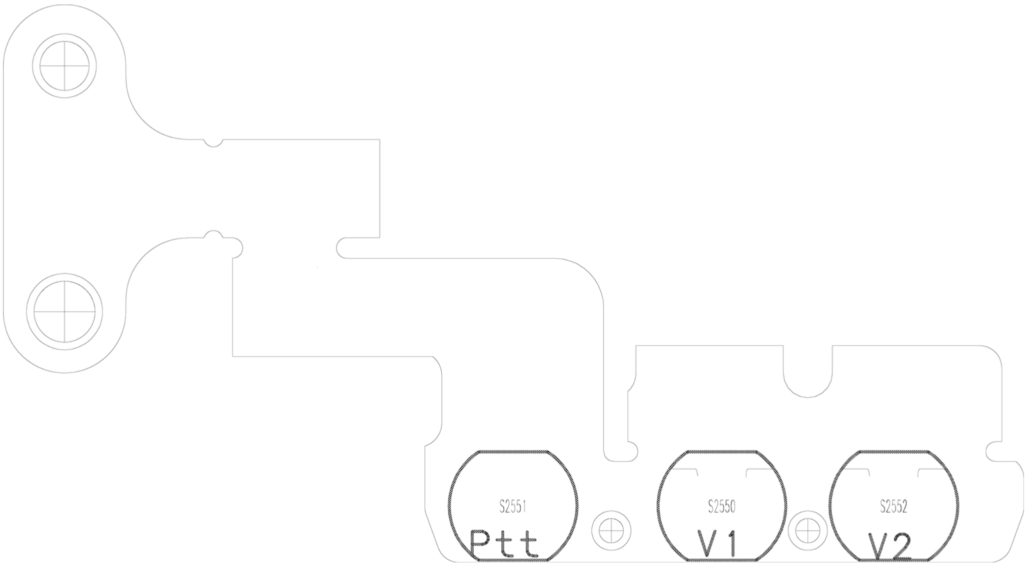

S2551
Ptt
S2550
V1
S2552
V2

Figure 20 Side keys

Backlight and illumination

There is backlight illuminating the display.

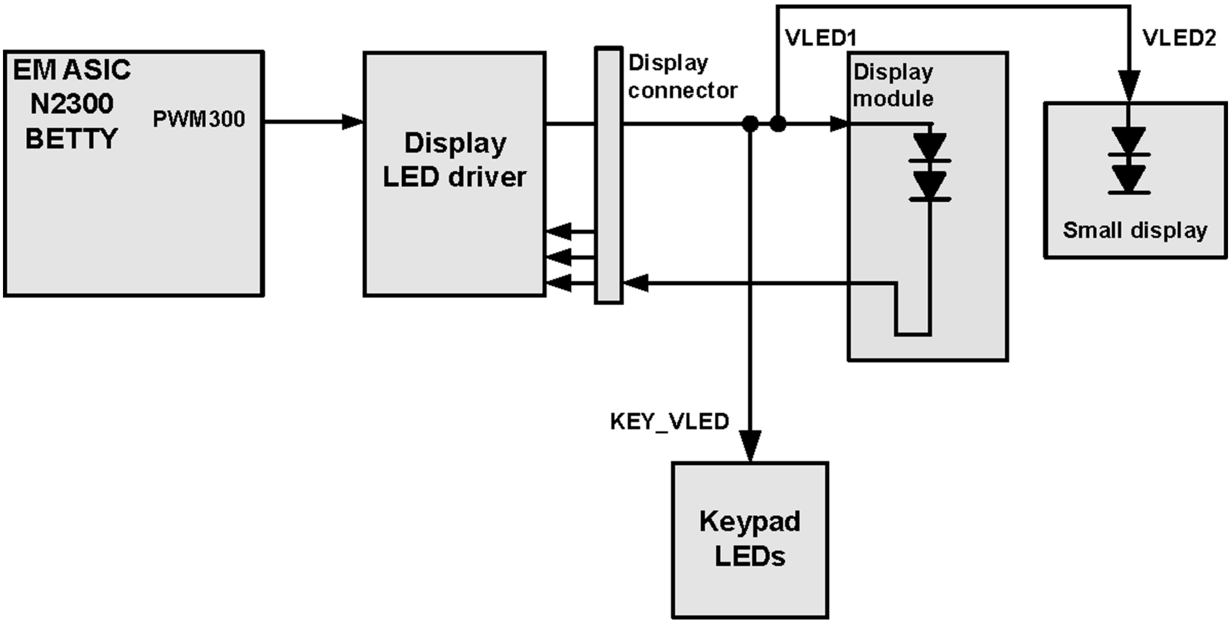

EM ASIC
N2300
BETTY
PWM300
Display
LED driver
Display
connector
VLED1
VLED2
Display
module
Small display
KEY_VLED
Keypad
LEDs

Figure 21 Backlight and illumination block diagram

Fold switch

The detection of the position of the fold is made through a Hall sensor and an IHF magnet. The magnet is positioned on the top board.

When the fold is opened, the applied magnetic field is high. This is sensed by an internal switch, also connected to GND. When the fold is closed, the Hall sensor is fluxed by magnetic field.

Audio concept

Audio concept

The functional core of the audio hardware is built around RAP3GS and N2200 AVILMA.

N2200 provides an interface for the transducers and the AV connector.

There are three audio transducers:

- 2 dynamic speakers (IHF and earpiece)
- 1 microphone module

N2200 also provides an output for the vibra motor.

All external audio accessories are connected to the specific audio connector.

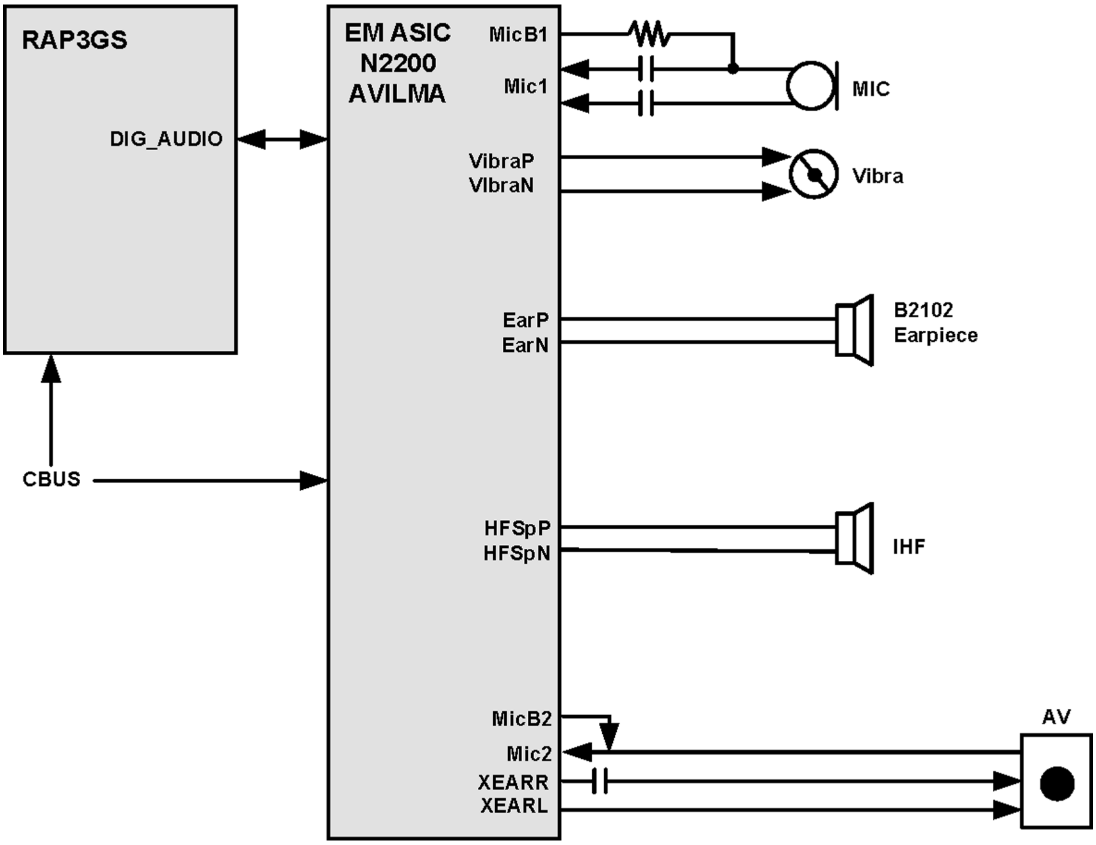

RAP3GS
DIG_AUDIO
CBUS
EM ASIC
N2200
AVILMA
MicB1
Mic1
MIC
VibraP
VibraN
Vibra
EarP
EarN
B2102
Earpiece
HFSpP
HFSpN
IHF
MicB2
Mic2
XEARR
XEARL
AV

Figure 22 Audio block diagram

Internal audio

The internal audio components are used in these modes:

	Hand portable (HP) mode	Internal hands free (IHF) mode
Microphone	X	X
Earpiece	X	X
Speaker		X

AV connector

Headsets and other galvanic accessories are connected to the specific audio input. The accessory mode is automatically enabled/disabled when a dedicated accessory is connected/disconnected.

> **Note:** When testing external audio through the audio connector, make sure that the specific accessory can be used with this phone!

■ Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

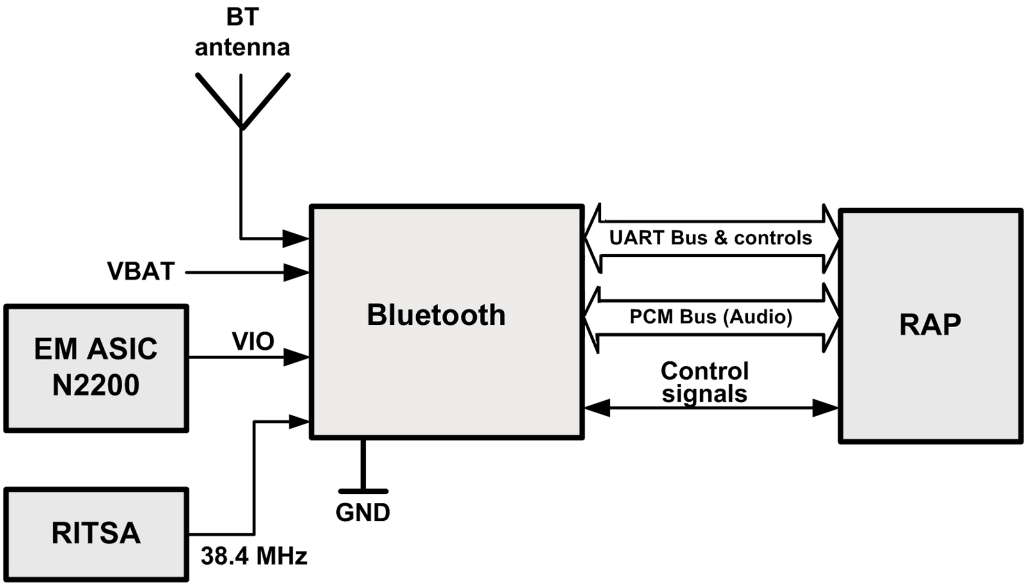

BT
antenna
VBAT
EM ASIC
N2200
VIO
RITSA
38.4 MHz
Bluetooth
GND
UART Bus & controls
PCM Bus (Audio)
Control
signals
RAP

Figure 23 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/ transmitter) is used for data communication and controls.

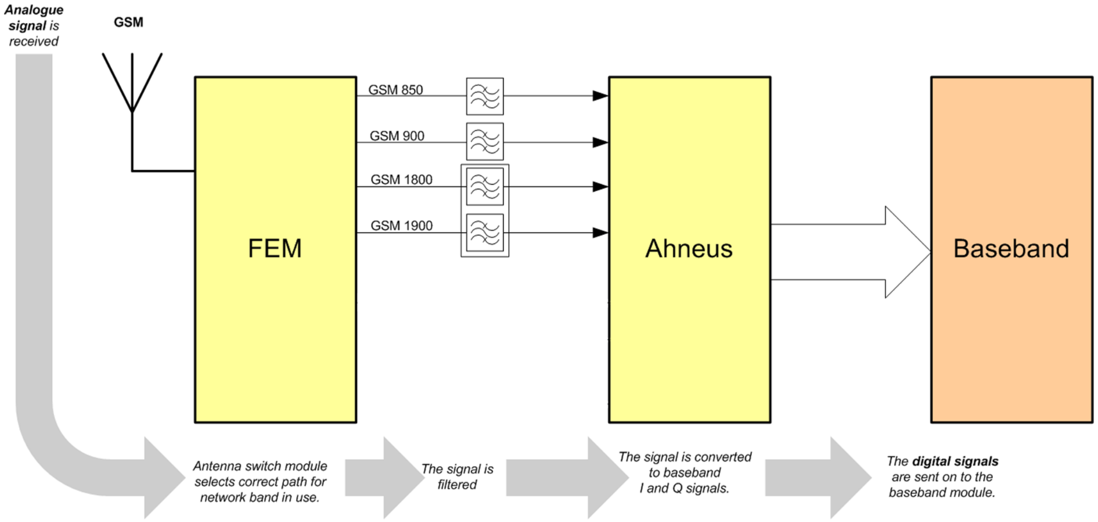
RF description

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

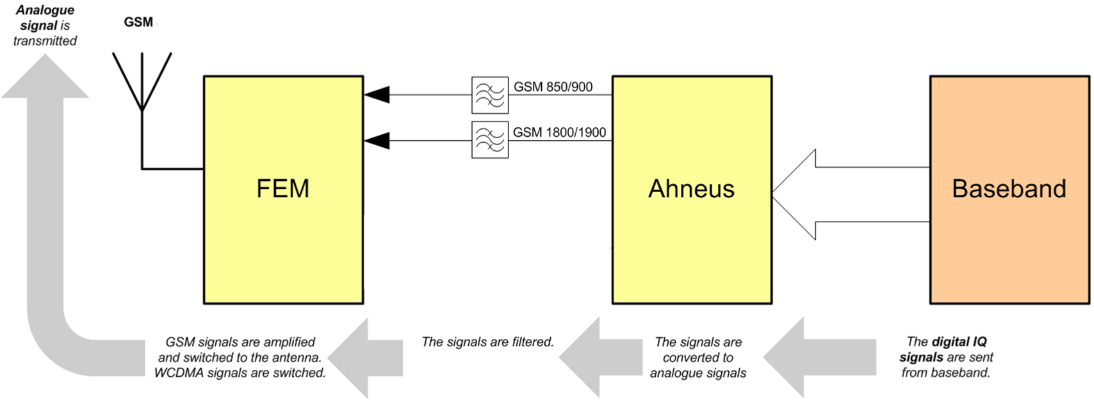
Signals with different frequencies take different paths, therefore being handled by different components.


Analogue signal is received
GSM
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
Ahneus
Baseband
Antenna switch module selects correct path for network band in use.
The signal is filtered
The signal is converted to baseband I and Q signals.
The digital signals are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.


Analogue signal is transmitted
GSM
FEM
GSM 850/900
GSM 1800/1900
Ahneus
Baseband
GSM signals are amplified and switched to the antenna. WCDMA signals are switched.
The signals are filtered.
The signals are converted to analogue signals
The **digital IQ signals** are sent from baseband.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology

DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group

LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card

RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage

WAP	Wireless application protocol
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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